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THE DAVIS ISLAND DAM ON THE OHIO RIVER.

In the olden days, when Fort Duquesne was on the extreme colonial frontier, the restless waters of its two encircling rivers met below the old fort to form the broad Ohio, and together flowed toward the sea in unrestrained freedom. In winter and spring mighty torrents rushed hurriedly past the fort and onward to the great valley. In summer and autumn, when heat and drought had quenched the tributary fountains, these torrents were replaced by broad, shallow streams, scarcely navigable for heavier craft than the frail canoes that formed their only fleet. But when the old fort had grown into a famous trading post, and then into a brisk city, this intermittent navigation became extremely disadvantageous. The large mineral resources of Western Pennsylvania were being developed, and their product of coal and iron distributed throughout the South and West by means of the natural waterways afforded by the Ohio and Mississippi.

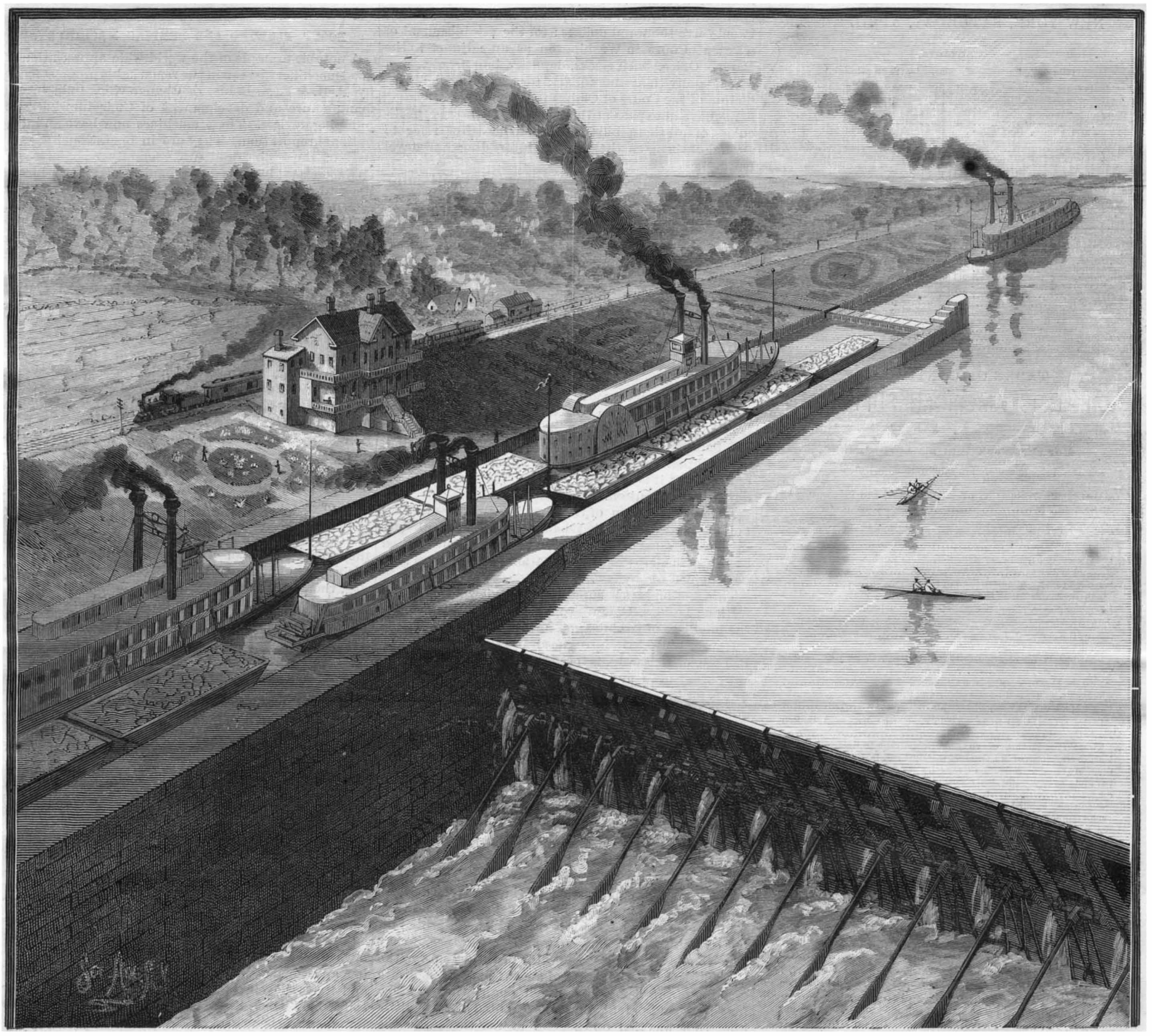
Pittsburg's commerce had stretched out its hands until her steamers had gone into the Northwest as far as the Upper Missouri, a distance of 4,300 miles, and on the South as far as New Orleans and the Gulf. Each year the traffic grows larger, until at the present time the tonnage of the port of Pittsburg exceeds that of New York.

Its growing requirements strongly demand improved facilities of water communication. The Monongahela has already been made navigable for many miles above the city by an elaborate system of fixed dams and locks. The Allegheny remains for the most part unimproved. Penetrating, as these rivers do, to the North and South, they bring a large region of rich and productive country into communication with the city at their mouths, and further improvements to navigation will extend the area of the tributary district. But the actual port of the city has not until recently been free from the interruptions caused by the low water of summer.

The only practicable way of improving it lay in damming the Ohio, and so raising the water level. But it would have been a manifest disadvantage to turn this immense tonnage through a lock all the year round in order to make the traffic continuous from one ice-bound season to the next. The two conditions necessary to be considered—an open passage at high water and a navigable pool surrounding the city and extending as far down the river as possible, at all seasons of the year—made a movable dam highly desirable. It was, therefore, decided to construct a wicket dam, on the plan devised by M. Chanoine, by which the river could be left open at high water, and during the dry season could be so far confined as to make a navigable pool surrounding the city.

Davis Island, five and a half miles below Pittsburg, was chosen by the Government engineers as the site for such a dam. The work was begun in August, 1878, and finished last fall. It was formally opened on October 7. A channel-way, 456 feet wide, between Davis Island and the southern shore has been closed by a permanent dam. The main channel of the river, between the island and the northern shore, is 1,344 feet wide. It is across this water-way that the movable dam has been constructed. A lock, 689 feet long and 110 feet wide, has been built on the northern shore. A land wall, having a total length of 1,649 feet, extends along the bank. A wall of solid masonry, 19½ feet high, 11 feet wide at its base and 8 feet on top, sepa-

(*Continued on page* 214.)



MOVABLE DAM ON THE OHIO RIVER AT DAVIS ISLAND.

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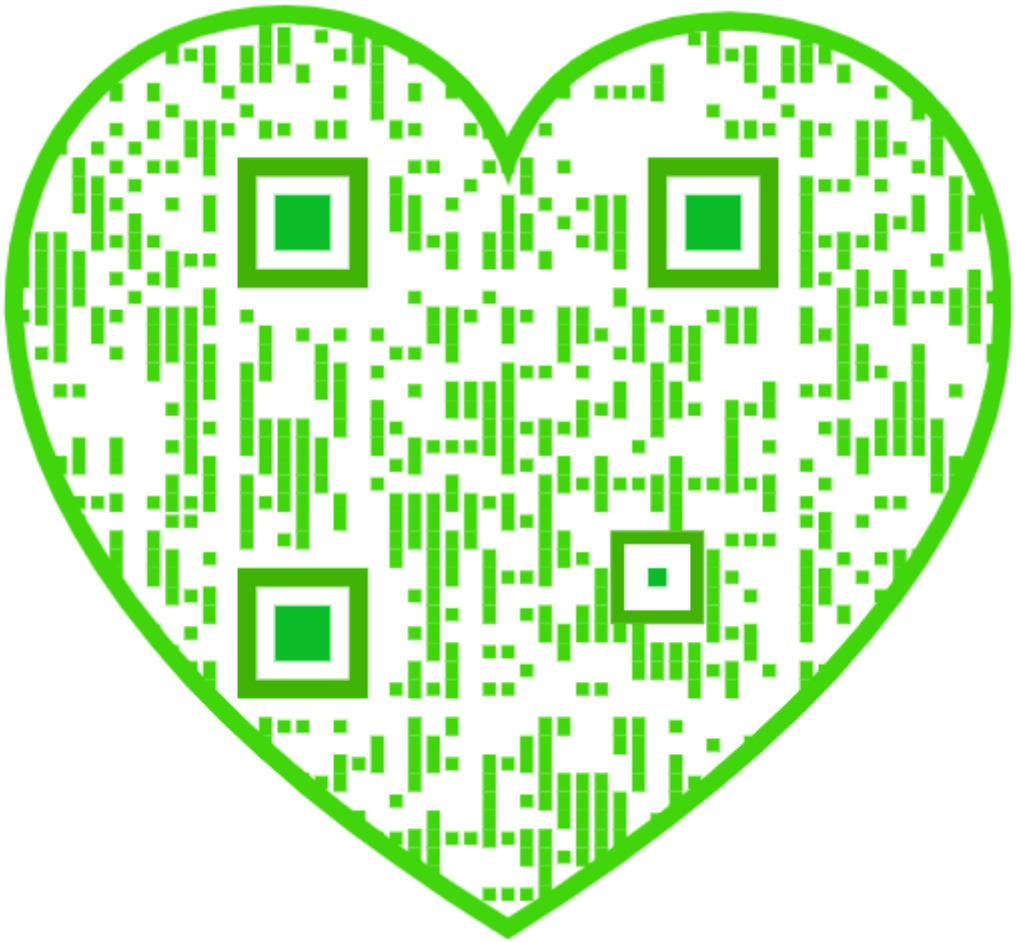

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THE PATENT BILLS BEFORE CONGRESS.

A large number of bills are now before Congress, designed to modify the existing patent laws. Regarded as a whole, the most notable point concerning them is their diversity of purpose, which appears to have been determined, more or less, by local prejudice or the degree of popular enlightenment in the district or State whence the bill originated. Among them are bills for the nullification of the patent laws; for depriving the inventor of the right to sue infringers; for giving all purchasers exemption from damages, if they infringe; for the purchase of patents by the Government; for limiting the amount of profits the inventor shall make from his patent; for extinguishing patents by money payments from the Treasury to inventors of valuable new inventions; for reducing the term of patents from seventeen to seven years; for depriving inventors or their assigns of their patents, if they attempt to hinder others from manufacturing the same; for compelling patentees to give bonds, if they bring suits; for infringement; for securing to those who buy an infringing device, the free right of use; for perpetuating testimony, reducing time for suits, etc.—these are among the proposed enactments adverse to inventors.

To encourage and benefit the inventors there are bills for extending the designs patent law; for extending the trade-mark law; for extending the benefits of the copyright law to foreigners; for preventing the sale of patent rights for debt; for preventing old foreign inventions from being patented here; for reviving and extending all old expired patents, and existing patents, so that a new term of eight years shall be now enjoyed; for extending the jurisdiction of the Circuit Court and facilitating patentees in recovering compensation for the use by Government of their patents; for the grant of patents for new flowers, fruits, horticultural and agricultural improvements; for the appointment of a commission to find out and report what changes are required in the patent laws—cost therefor, twenty-five thousand dollars; for the establishment of a Patent Court in Washington as an adjunct to the Patent Office, with clerks, deputies, bailiffs, etc., at a cost of many thousand dollars; for extending the jurisdiction of the Court of Claims to patent cases.

We have not space at this time to go into the particulars of all these bills, but shall hereafter refer to several of them, as they contain interesting and novel features.

For the present, let us look at Senate bill 1,511, introduced by the Hon. James Z. George, Senator from Mississippi. Its first section, of twelve lines, provides that any person who in good faith shall buy a patented article without notice that the same was covered by a patent, or without notice that the seller had no right to sell such article, shall thereby become the absolute owner, and no subsequent notice that the seller was not the lawful owner shall in any way impair the right of such purchaser as absolute owner.

If this bill is enacted into law, a man who buys stolen property—a patented wagon, for example—will become the absolute owner, the *bona-fide* proprietor will be debarred from recovering his property, and the lawful patentee will be done out of his royalty fee. It is not often that three such glaring outrages on justice are packed within so brief a legislative proposition. The bill perhaps represents the Mississippian idea on patents, but it is not very encouraging to honest industry and invention.

The second section of the same bill provides that all patents hereafter granted shall be subject to purchase by Congress, for the use of the people of the United States, at such reasonable valuation and terms as may be provided for by law.

This section seems superfluous in view of the first section; besides, Congress may at any time authorize the purchase of patents, and has frequently done so.

House bill 5,925, introduced by the Hon. Charles B. Lore, of Delaware, is intended to repeal all the present patent laws and establish another system of rewards for inventors. It provides that a patent shall be granted for one year only; the patent shall be submitted by the Commissioner of Patents to a committee of experts, who shall decide, finally, whether the invention is valuable or not. If found of no value, the inventor gets nothing, and goes to grass. If the Expert Committee find the invention of worth, they decide upon the cash value of the invention, which shall in no case exceed two hundred thousand dollars, and from that sum down, to be paid out of the Treasury by warrant of the Commissioner of Patents, the award to be final.

The Expert Committee would have a very delicate duty to perform in fixing the cash valuations, and they would constantly be subjected to risks and probabilities of making egregious errors. For instance, if they were to allow $10,000 as the value of the patent for the thread placed in the crease of an envelope to facilitate opening of the same, how much ought they to allow for the second patent, that was granted for the little knot that was tied on the end of the thread, so the finger nail could easily hold the thread?

Then, again, how much ought the committee allow for a simple device like the patent umbrella thimble slide, a single bit of brass tubing that costs a cent and a quarter to make? Probably the committee would think that one thousand dollars would be a most generous allowance, while two hundred thousand dollars—the limit of the bill—would, of course, be regarded as a monstrous and dishonest valuation. But the real truth is, the patent for this device is actually worth nearer one million dollars than two hundred thousand. The inventor, Dr. John J. Higgins, of this city, has already received over one hundred thousand dollars cash in royalties for his patents, and probably will receive three times that sum before they expire; while his licensees, the umbrella makers, are supposed to have already realized a million dollars' profits directly or indirectly arising from the control of this little article. Few people have an idea of the extent of the umbrella trade. In this city alone there is scarcely an umbrella manufacturing concern of any account that turns out less than two thousand umbrellas per diem.

We have not space to consider the valuations which other and greater inventions should probably receive, such as the harvester, the sewing machine, the printing press, the telegraph. The limit of compensation fixed by the bill would be far inadequate for such improvements.

As a means of getting rid of the surplus income of the Government, the bill in question is admirable. It beats the pension schemes, river and harbor steals, the land grabs, and Congressional private secretaryships all out. But the bill, as it stands, is full of difficulties, and likely to give rise to endless disputes and tergiversations, to overcome which and satisfy everybody, we advise Mr. Lore to amend his little bill as follows: First, grant patents and copyrights, free of charge, to all applicants; and second, the holder of any patent or copyright, on presenting to the Patent Commissioner a full assignment thereof, shall receive five thousand silver dollars, redeemable in gold.

ROOTS' BLOWING AND PUMPING MACHINERY.

A notable example of the world-wide appreciation of good machinery is seen in the remarkable progress made by P. H. & F. M. Roots, of Connersville, Ind., in the manufacture and development of their blowing and pumping devices. These machines now have an international reputation. They are in operation in every part of the globe, and are generally recognized by engineers as standards of mechanical excellence in the lines to which they belong. Some idea of the high esteem in which these machines are held in England will be gained from the recent illustrated article published in the *Engineer*, which we give in another column.

How Coal Made the "Bad Lands."

The "Bad Lands" of Dakota are said to owe their origin to the burning of the coal deposits that once existed there. They are situated principally along the Cheyenne and Grand rivers and the Little Missouri. They are from two or three miles to, say, twenty-five miles in width. In the long ago, the valleys of these streams must have been filled with drift wood. Then followed a period of drift, which buried the accumulation of wood under two or three hundred feet of sediment, sand, and gravel. The buried wood in time became coal, the veins being in some instances twenty odd feet in depth. Either from spontaneous combustion or from electricity, fires were started in these veins, and they gradually burned out, restoring in part the old water courses by means of the overflow from the accumulation of water in these newly formed basins. Looking upon them, here you see patches of slag, there great bowlders, showing unmistakable evidences of great heat, and on every hand scoria or burned clay, resembling broken brick. Where the fires were checked by the caving earth and the coal did not burn, mounds two or three hundred feet in height stand.

And according to the *Black Diamond*, a newspaper devoted to the coal interests, published in Chicago, in parts of Wyoming the same process is now going on; vast fields are undermined by subterranean fires, and the blackened, smoking plain is filled with desolation. Trappers say these fires have been in existence for a long time, and the traditions of the Indians point to the same conclusion.

Lack of Heat.

In the Superior Court of Massachussetts, in an action for rent against the tenant of rooms in an apartment house, it appeared that the steam heat which the landlord agreed to supply was inadequate; that additional heat became essential to a proper enjoyment of the premises; that the flues and chimneys were defective, or improperly constructed; that her apartments were often filled with dense smoke; and that the elevator service was inefficient. The court held that these grievances were an obstruction to the beneficial enjoyment of the premises, constituting a constructive eviction, and justified the tenant's abandonment.

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French Torpedo Experiments.

The *Temps*, of Paris, gives an account of a series of torpedo experiments which have been lately carried out under the direction of the French Minister of Marine, and which, according to that paper, proved far more successful than those performed by the British fleet in Bantry Bay. It would appear that the new minister, Admiral Aube, is desirous of investigating the efficiency of the torpedo service; and with that object he dispatched a number of boats from Cherbourg to Toulon *via* the Straits of Gibraltar, to test their sea-going qualities. The trial was most satisfactory, with one exception; the vessels proved very seaworthy, and passed through the Bay of Biscay successfully. But the crews found their quarters most unpleasant; the continual vibration, the cramped accommodation, the want of fresh air, and the general discomfort were such that after thirty-six hours the men were completely fatigued, and needed to run to port for rest. Hence it seemed proved that such boats were only fitted for operations near their base, and could not be sent on long independent cruises. But when the firing experiments were made, the results were altogether successful. On the 2d of March an attack was made on the ironclad Amiral Duperre, off the Hyeres Islands, under several different conditions. Two torpedo boats, Nos. 58 and 59, were moored by three cables, while the vessel steamed past them at the rate of 14 to 14½ knots per hour. They launched six torpedoes at her at different angles, some directed at the mast, and others at various parts of the ship. All these missiles struck the vessel and exploded their fuses. The next experiment consisted in boat No. 58 meeting the ironclad stem on, the former at the rate of nine knots and the latter at 14½. When a distance of 500 yards separated the two, the torpedo was ejected from its tube, and struck the ship. 11 meters behind the spur, exploding its mimic charge. Two first-class boats, Nos. 63 and 64, were then brought into action. The former advanced toward the bows of the Amiral Duperre at the rate of 12 knots, the large vessel steaming at the same time at 14 knots. The missile again struck, and when the second boat executed a similar maneuver, its projectile only missed by a few yards.

As far as they go, these trials are most satisfactory, and confirm the opinion that the torpedo boat will be the prominent feature in the naval battles of the future. But, says *Engineering*, when our contemporary goes on to suggest that the poorer results obtained in Bantry Bay were owing to the English torpedoes being badly equipped or unskillfully worked, he shows that he fails to appreciate the different conditions of the two cases. He might as well compare the shooting at Wimbledon with the waste of lead in a battle. In the placid waters of the Mediterranean, the torpedo had every advantage; in the first trial, the boats were securely moored, and in the others the speeds were evidently settled beforehand. The whole programme was arranged, and was carried out without hurry or excitement.

But in Bantry Bay there was no indulgence extended to the torpedo. The course of the Polyphemus was not known; she was to make a rush at the boom, but could choose her own direction and speed, so that the officers in charge of the boats had to be on the alert to select the most fitting opportunity, and had at the same time to determine what allowance must be made for speed. No wonder the theory that the wave which preceded the vessel deflected the missiles was advanced, and received great prominence in the newspaper accounts which appeared, a theory which our contemporary declares to be now exploded. If the French Minister of Marine will repeat his experiments under conditions more nearly resembling a battle, he will probably find some new hypothesis advanced to explain the poorer results which will be obtained.

A Magnesium Lamp.

A simple method of producing a powerful magnesium light for experimental purposes is described by a correspondent of the *Photographic News*. It consists of a methylated spirit lamp, the wick of which projects out from the side, near the top, being inclosed in a short spout. The flame of this lamp is made to play upon the bottom of a brass vessel, about the size of an egg-cup, which is intended to contain a mixture of sand and powdered magnesium. There is a small perforation in the bottom of the cup for the continuous escape of the powder, which must be so placed that while it falls into the flame of the spirit lamp, it does not drop upon the wick. The sand-cup arrangement is, in fact, on the hour glass principle. It is essential that the perforated end of the sand-cup should be kept hot by the flame, in order to prevent condensation upon it of water, to which the powder would adhere. A trial will show the required dimensions of the hole in the cup, the proportion of magnesium, and the management of the little apparatus. It is stated, in order to discourage attempts with a very obvious makeshift, that a funnel will not answer in place of the prescribed brass cup, because the neck would become choked with powder and water. The larger the proportion of magnesium that can be satisfactorily burnt in this way, the longer is the flame. With proper management, a magnesium flame 1½ yards long may be obtained. The best way to start the apparatus is to light the spirit lamp first, and then fill the cup with the charge of powder by pouring it in all at once from a sheet of paper, when the metallic flame will forthwith be produced. The same style of apparatus may be found useful for displaying the effects of other powders in a non-luminous flame.

Railroad Tie Plantations.

Hon. R. W. Phipps, Forestry Commissioner of Ontario, in a letter from Southern Kansas to the Toronto *Globe* writes:

"One railroad board here, knowing that the growing of wood, when set about in earnest, is neither a slow nor difficult task, has established in Kansas the largest artificial plantation of forest trees in North America. These railway gentlemen themselves gave out the contract for planting over a square mile of land with young saplings of the catalpa and ailantus; and their president, observing the success of their experiment, and impressed with its probable excellent financial results, has had planted at his own expense, as a speculation, as much more. These are situated near the little town of Farlington, Kan."

NIGHT SKY—MARCH AND APRIL.

BY RICHARD A. PROCTOR.

The Great Bear (*Ursa Major*) is now nearing the point overhead, the Pointers (α and β) aiming almost directly downward toward the Pole Star. The line from this star (α of the Little Bear, *Ursa Minor*) to the Guardians (β and γ) is now in the position of the minute hand of a clock about 13 min. after an hour.

Cepheus lies north, low down, *Cassiopeia* on his left, the Cameleopard above her, *Andromeda* just setting, almost due northwest, on the left. Perseus is due northwest, rather low, the Charioteer (*Auriga*) on his left, but higher. Setting between west and northwest we see the Bull (*Taurus*), with the Pleiades and the ruddy Aldebaran. *Orion* is almost prone in his descent toward his western grave. The Twins (*Gemini*) are due west, in the mid-heavens; the Little Dog (*Canis Minor*) beside them on their left, the Crab (*Cancer*) above, the Greater Dog (*Canis Major*) below, chasing the Hare (*Lepus*) below the horizon. Just behind the Dog the poop of the Great Ship (*Argo*) is also setting.

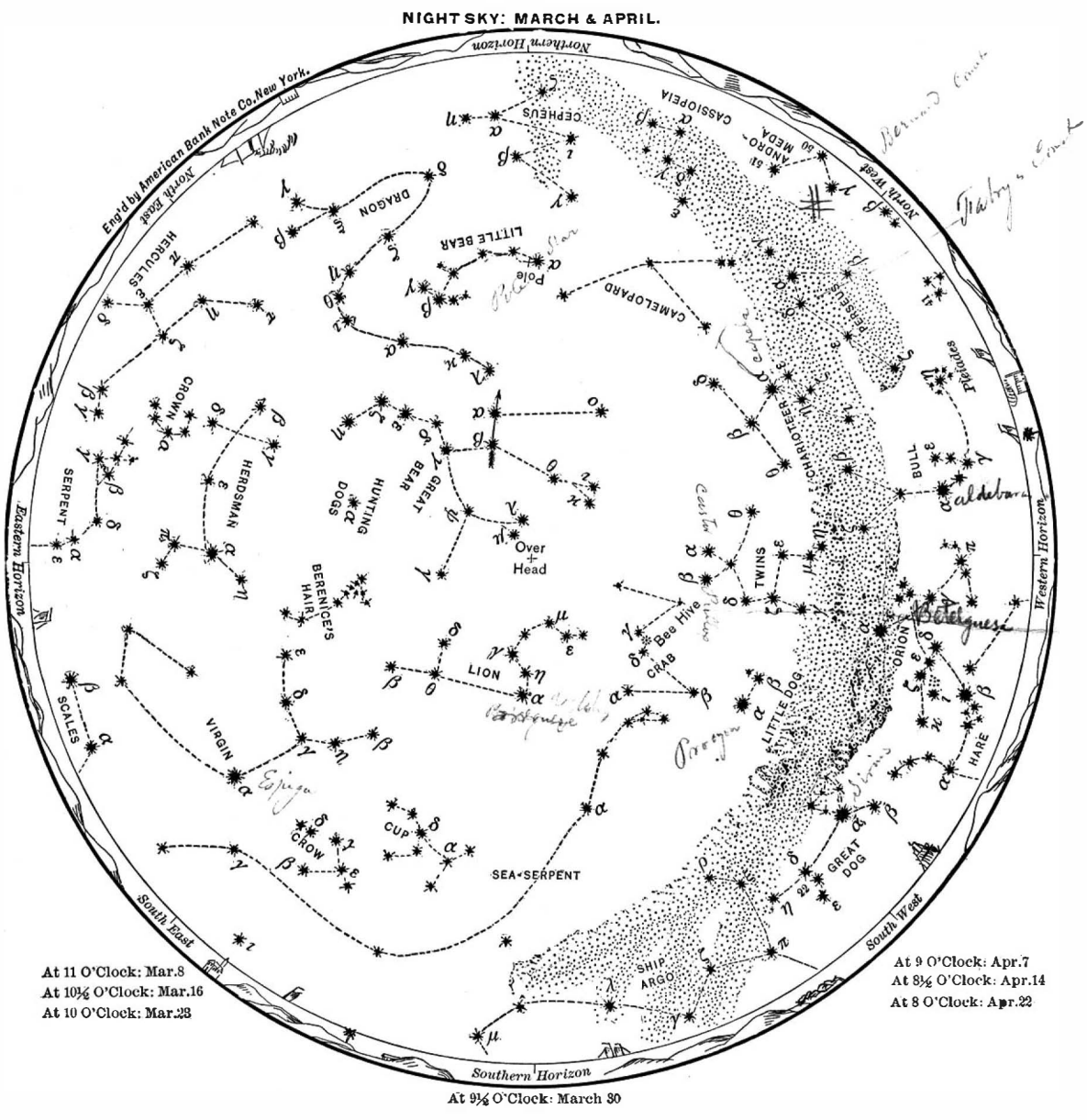
The Sea Serpent (*Hydra*) now shows his full length, rearing his head high in the south. Observe the darkness of the region around his heart, α, Alfard, the Solitary One. The Cup (*Crater*) and Crow (*Corvus*) stand on his back.

The Sickle in the Lion (*Leo*) now stands with handle upright, due south. Below the tail stars of the Lion we see the Virgin (*Virgo*), with the bright *Spica Azimech.* The set of five third magnitude stars above was called by the Arabs, for reasons not explained, the "Retreat of the Howling She Dogs."

Behind the Lion, due east and high up, we see *Coma Berenices*, the hair of Queen Berenice, between which and the tail of the Great Bear we see in the chart one star only of the Hunting Dogs (*Canes Venatici*).

The Herdsman (*Bootes*), still on his back, pursues in that striking and effective position the Great Bear. Below the shoulder stars of the Herdsman we see the Crown (*Corona Borealis*), near which, on the right, low down and due east, the head of the Serpent (*Serpens*) is rising. *Hercules* is also rising, but in the northeast.

Lastly, the stars of the Dragon (*Draco*) can be seen curving from between the Pointers and the Pole, round the Little Bear, then back toward Hercules, the head of the Dragon, with α, the bright eyes, β and γ, being rather low down, and somewhat north of northeast.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed; counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

Hints to Draughtsmen.

Draughtsmen, as well as others, have their little kinks, and the publishing of these kinks often helps others. A practical draughtsman in *Wood and Iron* gives the following simple suggestions, which will likely prove useful to some reader. In mixing up inks, the process is very much expedited by heating the dish and water in which it is mixed before commencing. It often happens in the summer that the flies walk over a tracing and eat off the ink in a very provoking manner. The use of vinegar instead of water will prevent this. In making a tracing, the cloth will take the ink much better if it is rubbed over with chalk. Tracing cloth that has been rolled up may be straightened out effectually and expeditiously by drawing it over the edge of a table or drawing board, holding it down meantime with an ordinary three-cornered scale. When there are a large number of drawings made and kept, a great deal of trouble and confusion can be avoided by making all the drawings on extra standard sizes. If a size of 16 × 24 in. be adopted, then the next larger size would be equal to two of these, or 24 × 32 in. This enlarging or reducing process may be carried as far as the circumstances require, but it is always best to do it by the doubling or halving process if possible.

One of the advantages of standard sizes of drawings is that they may be kept in a case of drawers, the size of which is made to accommodate the standard sizes determined upon.

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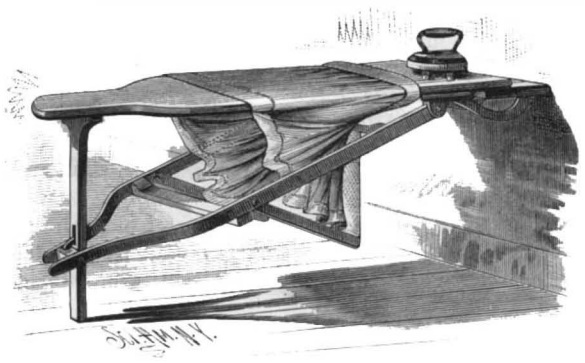
IRONING TABLE.

The ironing table here shown is strong and durable, can be folded very compactly, and is provided with an apron to prevent the articles being ironed from coming in contact with the floor. Pivoted near one end of the board are two bars whose opposite ends are bent toward each other and pivoted to the bottom of a leg having a cross piece at its top. The bars are united by cross pieces, and between them, at the curves, is pivoted a frame on which a piece of fabric is secured; the free end of this frame is supported by a strap. To adjust the table, the edge of the top of a kitchen table is passed between the end of the board and the ends of prongs secured to the



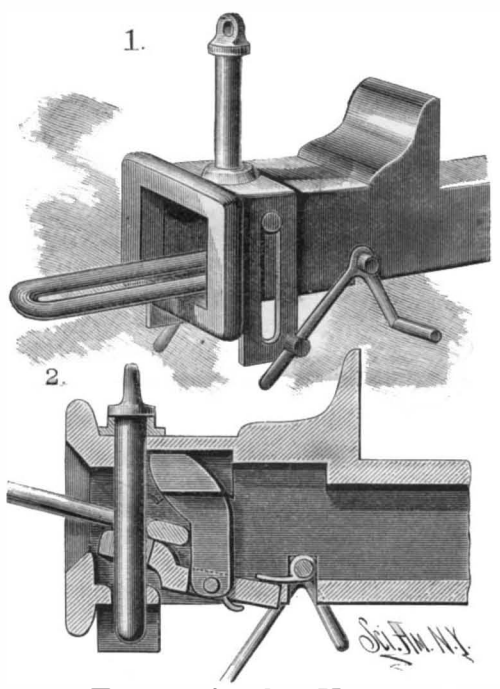
JOHNSON'S IRONING TABLE.

under side of the board. The bars are swung down, and the cross piece on the leg is swung up against the under side of the board. A catch on the leg engages with a cross piece on the lower ends of the bars, and holds the parts in place. The frame drops, and forms a pocket for receiving parts of the garment being ironed. To fold the board, the frame is swung between the bars, the leg is swung on the lower cross piece, when the bars are swung against the under side of the board; a latch then locks the parts in place.

This invention has been patented by Mr. T. N. Johnson, whose address is P. O. box 735, Rome, N. Y.

CAR COUPLING.

The drawhead of the car coupling here shown is in general of the usual construction, and is provided with holes for the coupling pin, the head of which rests upon a collar formed on the middle of a cross piece of a U-shaped frame placed on the drawhead near the front. The side pieces of this frame are slotted to receive guide pins; pins project from the lower ends of the sides of the frame. The link-lifting bar is pivoted in a slot in the bottom of the head, and is made with a fork at its front end. Pivoted in a slot in the lifting bar is a dog having at its upper end laterally projecting guide lugs, which project over curved shoulders on the inner sides of the drawhead near its top. A short arm projects from the lower end of the dog through the slot and under the bottom edge of the lifting bar. Journaled in a transverse recess in the bottom of the head is a shaft having a handle piece and an arm in-



WESTOVER'S CAR COUPLING.

clined downward toward the front, so as to strike the pins on the sliding frame. The coupling link is of the usual construction.

Before the cars are coupled, the pin is rested on top of the dog. The entering link strikes the dog and swings it from under the pin, which drops through the link and couples the cars. By turning the shaft, the entering end of the link can be raised as shown in Fig. 2. To uncouple the cars, the pin is drawn up, when the dog swings under it; or the shaft can be so turned that its arms will raise the frame, which will carry the pin up with it. The short curved arm on the dog prevents it swinging too far front.

This invention has been patented by Messrs. G. D. and C. H. Westover, of Cadillac, Mich., who will furnish further particulars.

How to Secure Water Supply.

About a year ago I saw some articles in the SCIENTIFIC AMERICAN on storing wind power. One of them, I believe, was for pumping water in a reservoir for irrigation purposes.

I have an idea of using the same force in a still simpler way, provided locality suits the case, viz., to make that untiring fellow, the wind, bring sufficient snow drifts on the most elevated portion of the farm, where, on the lowest end of it, a reservoir is built, into which the water is collected by proper drainage, when the snow melts.

To bring the snow on the desired strip of land, it is simply necessary to build a high fence in a north and south direction, on the east side of which the snow will accumulate in sufficient quantity, almost every winter, to fill a good sized reservoir, if the obstructive fence is at least from 25 to 50 rods in length; but better than a fence would be a belt of forest trees, of at least two rows of evergreens.

That such a strip of trees planted on the west side of a farm pays many times for its cost in the way of protection to farm crops, I have ample experience.

G. G.

AN IMPROMPTU HEN COOP.

The demand for coops for sitting hens or for mothers with young broods of chickens is often unexpected, and frequently this demand exceeds the supply. One of the easiest ways to meet this want is to follow the suggestion of the accompanying cut, and make use of old flour barrels and apple barrels, which are now long since relieved of their winter contents. The barrel should be partly buried in the ground, the excavated earth being thrown back into bottom of same, and a comfortable and sheltered retreat is thus provided. In case the coop is to be the home of a young family of chickens, it is only necessary to add to the barrel a few slats at the opening. If a few nests of this kind are scattered about the yard, they will be found very attractive to sitting hens, who may be supplied with eggs when it is found that they are earnest in their intentions. It is not proposed that this species of nest shall take the place of the old fashioned coop, but it will be found to be a desirable resource in case of emergency.

AN IMPROMPTU HEN COOP.

India Calling for Our Inventions.

A gentleman residing in Calcutta having seen our illustration and description of a separator for wheat in the SCIENTIFIC AMERICAN, writes to this office a long and very interesting letter, giving important statistics relative to the growth and exporting of wheat from India, and suggests that it is a good market for meritorious inventions in the agricultural line, and especially the class pertaining to the cultivation and cleaning of wheat.

He says that "the extension of our railway system has made it possible for wheat to be brought down to our ports in vast quantity, and producers would get much better prices for at least four million tons annually if they had good wheat cleaners."

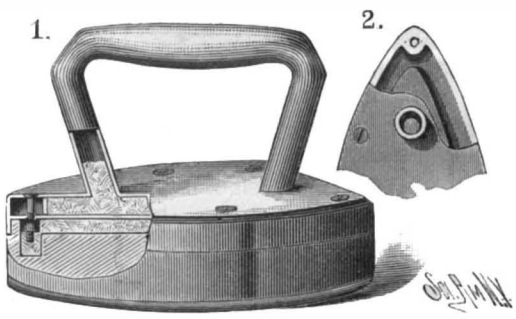
India, China, and Japan, he adds, are advancing rapidly in the path of material progress, and Indian trade has advanced with greater rapidity than that of even America. The writer laments that so few important improvements patented in the United States find their way to India, and promises in a future letter to send his further observations on other inventions most needed in his country.

Curious Request.

Editors are constantly in receipt of curious letters. Here is one of them, sent to the editor of *Harper's Magazine* the other day. It was from a lady who wrote that she was dying, and that her physicians told her she would be dead before the conclusion of Mr. Howells' story, "Indian Summer," then running in the *Monthly*. She was very much interested in it, and did not want to die until she knew how it was going to end, and she begged the editor to let her read the advance sheets, that she might die happy.

IMPROVED SAD IRON.

This sad iron—the invention of Mr. G. S. Castagneto—is so constructed that the heat cannot be reflected from the top or handle, and thus cannot pain the hand of the person using the iron. The space between the top of the cast bottom piece and a sheet metal plate held on the slightly raised edges is filled with asbestos. The edges of this plate are turned up to form flanges, on which rests a metal plate having its edges turned down to form flanges, which rest against the outsides of the others; asbestos is filled in between the plates. On the upper plate is a hollow sheet metal handle, the ends of which are filled with asbestos. In the top of the handle are holes, through which the hot air can escape. The several pieces are held together by



CASTAGNETO'S IMPROVED SAD IRON.

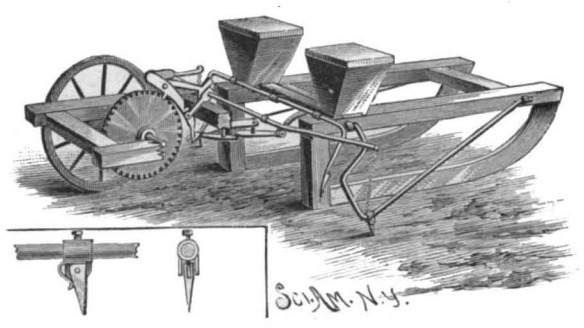
screws. The layers of asbestos prevent the top plate being heated from the bottom piece, and thereby keep the heat from the hand.

Additional particulars concerning this invention can be had by addressing General Stephen Moffitt, of Plattsburg, N. Y.

HILL MARKING ATTACHMENT FOR CORN PLANTERS.

The engraving represents a hill marking attachment for corn planters, constructed in such a manner as to be operated to mark the ground by the movement of the seed-dropping slide, and raised from the ground automatically as the planter is drawn forward. The forward part of the planter frame and the rear part are hinged to each other. The forward part is provided with channel-opening runners, seed boxes, and a seed-dropping slide in the ordinary manner; the slide can be operated by hand, by a lever or by any of the well known means. The points to mark the ground in line with the cross rows are formed on bent rods journaled to the side bars of the forward frame, as shown in the cut. These points—shown in the small views—are so held as to yield, should they strike an obstruction. The points can be held out of contact with the ground by shoulders formed on the ends of a shaft placed in bearings attached to the ends of the side bars of the forward frame; springs hold this shaft so that they will engage with certainty with the marking bars.

To the middle of the shaft is rigidly secured an arm, which projects so as to be struck by a double inclined projection formed upon the lower side of the seed-dropping slide, thus rocking the shaft and withdrawing the marker bars each time the slide is moved to drop seed. To the marker bars are attached chains leading to the ends of arms projecting from a shaft rocking in bearings on the forward part of the rear frame. Fixed at the middle of this shaft is an arm, in whose forked end is pivoted a lever pawl having a tooth to engage with a ratchet wheel on the axle of the drive wheels.



SHUPE'S HILL MARKING ATTACHMENT FOR CORN PLANTERS.

This pawl is so connected by levers that, when the slide is operated to drop the seed and release the markers, it drops into gear with the ratchet wheel. As the wheel turns forward it carries the pawl and arm with it, and turns the shaft so that the chains will raise the markers until they are caught by the catches. The further movement of the wheel releases the pawl, which is raised by the weight of the arms of the shaft on the rear frame into position, ready to be again dropped when the slide is again moved to drop seed for another hill. A slight change is made when the slide is to be operated by a check wire.

This invention has been patented by Mr. Charles C. Shupe, of Mendon, Ill.

A LARGE gas vein was recently struck at Piqua, Ohio, at the depth of 400 feet.

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Lubricating and Cylinder Oils.

An interesting and instructive address on lubricating and cylinder oils was recently delivered by Scott A. Smith before the Rhode Island Engineers' Association, Providence.

He made comparison of different oils, regarding the impurities they contained, and explained the methods employed in refining. He said that for purposes of lubrication, where metal is working upon metal, sperm oil is the best, lard oil second, neat's foot third, and tallow oil fourth. The best grade of animal oil is that which contains the least stearine and no free acid.

Regarding the friction of oils upon their own particles, lard oil is two and one-third times as long in running out of this tube at 70° as sperm; then we must consider that we have the weight of one ounce of oil compared with another ounce moving upon itself. The result, so far considered, is vastly in favor of sperm as a light running oil; but in actual use, where bearings have a stress of 300 pounds and upward to the square inch, then this great difference tends rapidly to disappear.

If you work bearings with 1 pound pressure to the square inch, use sperm; if at 500 to 600, or as a locomotive practice up to 1,200 and more, then you may find lard the best, particularly at about half the price per gallon of sperm. Petroleum, consisting of hydrogen and carbon, is eminently fitted for lubrication, as it contains none of the destroying element—oxygen.

The average quality of petroleum oils has been much improved within a few years, partly for the reason that consumers have exacted a better article, and partly because of the competition of dealers, who have marketed their oils on their merits. It is, I think, not too much to hope for that, within the next ten years, or less, the qualities of pure petroleum oils may be so improved that, with improvements in the shaft bearings of machinery, and some provisions against accidental overheating, all lubrication may be possible with petroleum alone. Use as little animal oil as possible, on account of high cost, waste by careless handling, its active acid qualities, and its tendency to gum.

The gumming of animal oils exists independently of the active acid principle, and is the result of oxidizing. Petroleum oils have no active principle to neutralize the acid of animal oils.

Petroleum cylinder oils, so made that they will do the best work in any and all engines, are the result of much scientific and practical study, and the processes of their manufacture are very complicated. They contain no acid, and cannot develop any by heat and work. Their flashing point is not less than 400°; gravity, 25° to 28° at 100° Fah.

In conclusion, petroleum cylinder oils have peculiar and distinctive qualities to recommend them for this special use—great heat-resisting power, freedom from all acid qualities, freedom from all tendency to gum, and their remarkable property of spreading on heated surfaces.

The speaker suggested that the Engineers' Association might gather in the experience of its individual members in past years with various kinds of oils under the conditions of actual use. I make bold to formulate this plan:

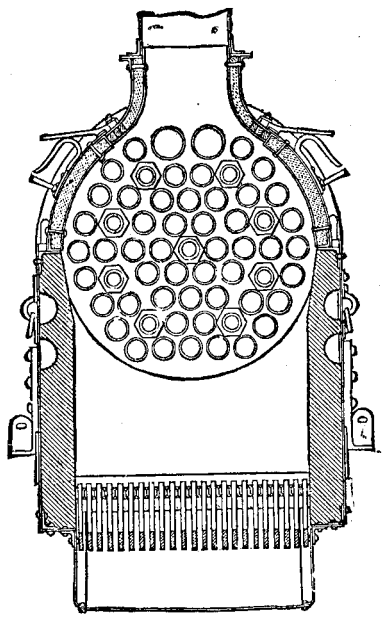
Prepare and have printed suitable directions, with questions to be answered; also, a request for a full account of their experience with oils; with, however, this requirement, that no one shall give the maker's name, or any reference thereto, but simply describe the oil to the best of his ability.

Means can be furnished members by which they can get the cold test, gravity, and flash of the oil now in use.

The reasons why I would exclude the maker's name are these: The prime object should be to get information about oils, and not to advertise them.—*Providence Journal.*

A COMPACT BOAT BOILER.

Our illustrations represent a boat boiler designed by M. V. Cadiat, a French marine engineer. In this boiler the heating surface is derived principally from a group of brass tubes inclined at an angle of 45 deg., and



CADIAT'S IMPROVED STEAM BOILER.

through which the water circulates. These tubes stand immediately in front of the grate and are fixed in two tube plates. A certain number of the tubes are made to act as stays by being fitted with double nuts at the ends. Each of the tube plates has a thickened margin; the upper one is bolted to a spherical steam chamber, and the lower to a smaller chamber or dish, provided with mud hole doors. Two of the tubes which are at the side of the group further from the fire are of a large diameter, in order to provide for the downward current of water. A baffle plate in the dome, at about the water level, aids the circulation by deflecting the stream toward the larger tubes.

The spherical dome carries the safety valve, water gauge, and the like. With the exception of the water gauge all the fittings are grouped upon a special pipe connected to a steam separator inside the dome. This consists of a helical tube of three turns, upon the outer side of which there are a number of small holes, provided with inclined plates. As the steam and water rush through this pipe the particles of water are, by the centrifugal force, thrown through these holes into the casing, from whence they return to the boiler, while the steam is emitted dry at the bottom of the helix. The boiler is lagged with an envelope which surrounds the upper part of the group of tubes, and is fixed to the inner sides of the tube plates. The furnace is lined with firebrick. Neither the walls of the firebox nor the casing around the tubes adds to the heating surface of the boiler. The dome is covered with felt, and covered with polished brass. The arrangement of the doors for gaining access to the tubes, and the manner of carrying the chimney, are clearly shown in the engravings.

Engineering says: We are informed by the makers, MM. Edouard Mourraille & Co., Toulon, France, that a trial of one of these boilers has given the following results: The boiler in question had a heating surface of 63 square feet and a grate surface of 2·15 square feet. The pressure was 100 pounds per square inch, and the weight of the boiler and water one ton. It was fitted in a small boat having a single cylinder non-condensing engine, with the exhaust in the chimney. The coal burnt per hour, with easy firing, was 154 pounds, or 71 pounds per square foot of grate surface. This evaporated 921 pounds of water, or 6 pounds per pound of coal. The indicated horse power was 20.

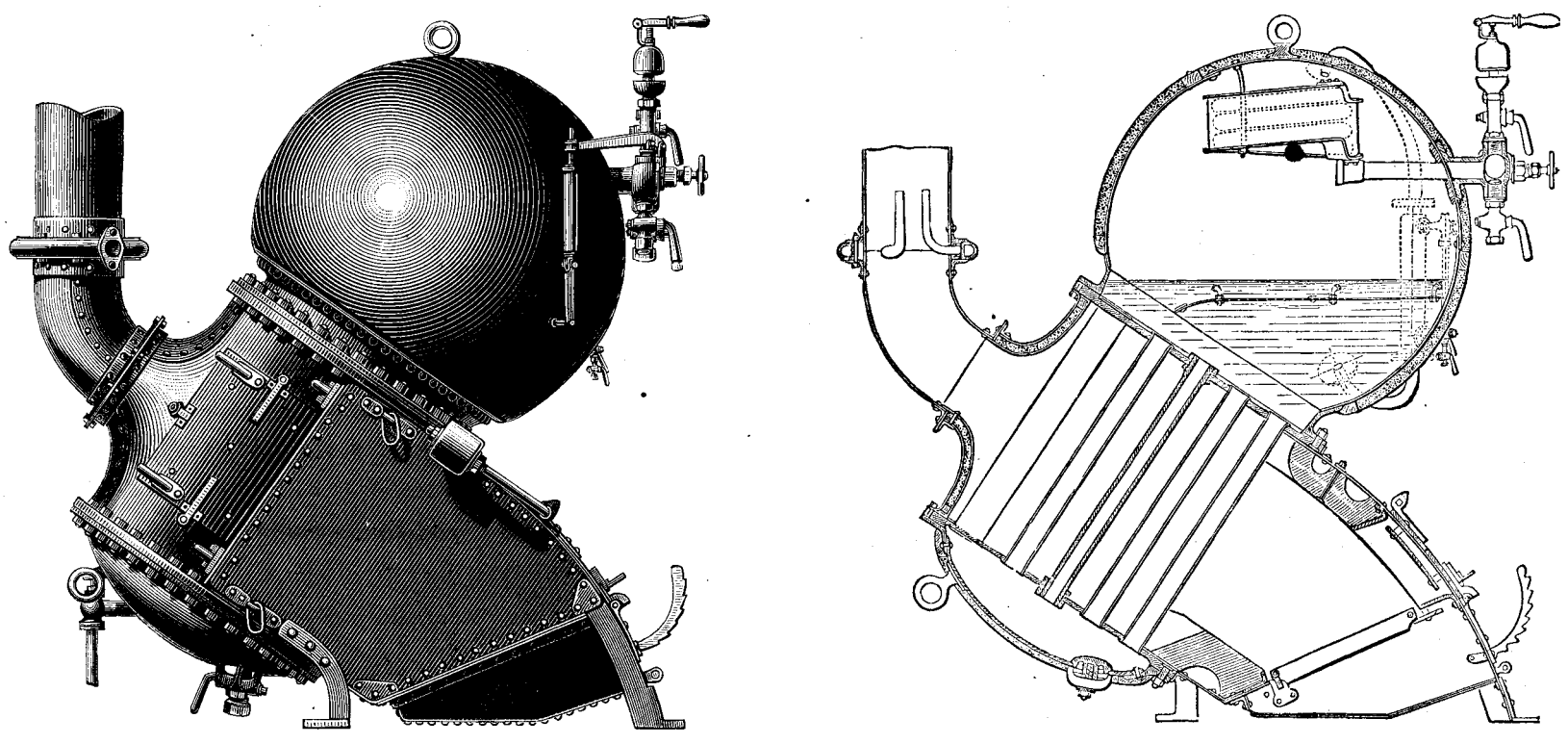
The merit of the boiler lies in its compactness and the ease with which the internal parts can be reached. The entire wear is thrown upon the tubes, which can be easily renewed.

The Utilization of Bagasse.

The utilization in sugar making countries of the residual canes—bagasse—for fuel and gas making is an important practical problem which has yet been only partially solved. The great drawback to the profitable combustion or carbonization of this highly carbonaceous material has been the large proportion of water which it contains, as ordinarily treated by mills, presses, etc. It is stated, however, in the *Revue Industrielle*, that M. Pellet has succeeded in devising, to the order of the Fives-Lille Company, a system of dealing with the material which produces, by direct compression, a combustible containing not more than 40 to 50 per cent of water. In this state the waste can be burnt directly in boiler furnaces or carbonized without previous drying. This result is obtained by a preliminary division of the pieces of cane in a special apparatus, whereby the after-compression of the material by presses of any convenient kind may be usefully secured. The compressed material is formed into bricks by the addition of powdered fuel, ashes, or lime. It is cited as a remarkable instance of the utilization of a waste product reacting upon the original value of the material, that this conversion of waste sugar-cane into a useful fuel will render possible a special treatment of the cane, which will result in simplifying processes, saving labor, and increasing the yield of the raw article.

Accidents from Machinery.

It has been settled by a decision of the Supreme Court of Pennsylvania that machinery, once adjusted to its place in a factory, is presumably properly constructed, and may be operated without danger to the operative charged with its care. In case of an action for damages from injuries, there must be direct and conclusive evidence to overcome this presumption. The meaning of this decision to employes in this State is that any personal injuries they may sustain from exposed machinery will be at their own risk, so far as legal remedies are concerned. At first sight this may seem a hard thing, but reflection will lead inevitably to the conclusion that no other basis of equity could be found by the court. To make the owner of machinery liable for individual carelessness is to put a premium upon stupidity. The remedies for gross neglect of precautions to secure ordinary safety will never be denied, but the reckless trifler with whirling wheels must run his own risks.—*Phil. Record.*



CADIAT'S IMPROVED STEAM BOILER.

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James Watt Anniversary.

The anniversary dinner of the foremen engineers of the Clyde, in honor of the third jubilee or 150th anniversary of the birth of James Watt, was held on Saturday evening, the 23d of January, in the Grand Hotel, Charing Cross, Glasgow, under the genial presidency of Mr. John Ward, of the Leven Shipyard, Dumbarton. The occasion was marked with all that enthusiasm and *esprit de corps* for which these annual dinners are famous. The chairman was supported by Mr. F. H. Underwood, Consul for the United States. The croupier's chair was filled by Mr. G. Russell Motherwell, who is president-elect for next anniversary. The gathering, which numbered about one hundred and fifty, also included many of the leading members of the trades interested on the Clyde.

The chairman, in submitting the toast of the evening, "The Memory of James Watt," gave a succinct and choicely worded *resume* of the life and work of this illustrious engineer. In introducing his subject, he said: "Just as we love to remember in our family life, and our national life, the birth anniversaries of those near and dear to us, or who have done well for their country, and deserve well at our hands, so do we, or we ought, as lineal descendants of our patron saint, take pleasure in meeting together to celebrate this, the third jubilee anniversary of his birth, and hear once again of the intellectual battles he fought, of the victories he gained, and of the honors he won—battles none the less real because they were bloodless; victories none the less enduring and of lasting benefit to his country and to mankind in general because they were peaceful; and honors which deservedly crowned him with wealth and fame, but which fell far short of what would doubtless have been his had his battles been of a military character, and his victories gained at the loss of precious lives and the desolation of many hearths and homes."

Having traced in a highly interesting way the early efforts and later successes of Watt, the speaker said that it was a duty lying on "any one proposing this toast to bring to remembrance the great help Watt had received from that great and inventive genius who was so closely associated with him in his later improvements on the steam engine. I refer to our countryman, William Murdoch. This great and original genius was engaged by Boulton and Watt in 1777 (three years after their commencement in business), first as a mechanic at 15s. a week, and latterly in directing the erection and working of the mine engines set up by the firm in Cornwall, the salary given him by them for this work being £1 per week. At the age of 44 he asked for an increase, and not receiving a prompt reply, he resigned his position.

"As a result of this the firm showed the appreciation in which they held him by offering him the general managership of their works, at a salary of £1,000 a year, which he accepted. But that his resignation had taken place before any tangible appreciation of his worth was given by the firm, even when holding a position of trust, leaves an unpleasant feeling in the minds of impartial thinkers. As the inventor of the first locomotive engine, of the first oscillating and the first slide valve engines, Murdoch showed his wonderful ability and genius; but especially as the founder and inventor of gas lighting will his name ever be best known to mankind. If, however, Boulton and Watt made scant recognition of his worth until compelled by his leaving them to do so, what shall we say of those who have for many years taken the free gift which he gave to the world, and especially those who have and are making large fortunes thereby, without any recognition whatever? Right glad am I to know, gentlemen, that there some members of his profession with us this evening who are at this moment striving to atone for past neglect, and in the success with which their efforts for a national memorial to him are being crowned, are doing honor to his memory as well as to the profession which they themselves adorn."

Speaking of later times, the speaker concluded: "While great improvements have since been made upon the steam engine, yet in essential points it still remains as Watt left it, his successors in the profession being content if they could simply add their stone to the structure whose foundations have been so firmly laid. The men of the Clyde, and particularly members of this association, have pride in knowing that the greatest improvements on the steam engine since the days of Watt have emanated from brains trained, as his was, on the banks of the Clyde—notably surface condensation and the compound marine engine; while more recently engines with great pressures, and triple and quadruple expansions, are the latest laurels of the profession. And so the steam engine goes steadily forward on the march of progression, until now we see it the great lever which has influenced society, and brought about more changes upon the face of the world than any other power. Steam navigation has also made great progress within the last 25 years. True we have the Great Eastern, which must ever remain a tribute to Brunel & Scott Russell's genius, but as a profitable and speedy steamer she was never successful. Dr. Lardner, in 1835, addressing a Liverpool audience, said: 'As to the project which was announced in the newspapers of making the voyage directly from New York to Liverpool, it was, he had no hesitation in saying, perfectly chimerical, and they might as well talk of making a voyage from New York or Liverpool to the moon.' That declaration can never be more fitly recalled than at a time like this, when marine engines admit of vast power being packed in little space—when we have steam at sea as on shore, cheaper than the unbought wind, and when enormous floating palaces are constantly making the passage in a little over six days. What further advance remains to steam navigation it would be unwise to conjecture, but we know that at the present moment we are building on the Clyde vessels to beat the highest speeds we have yet reached, and even then the limits of steamship achievements will not be defined."

Succeeding toasts were: "The Trade and Commerce of Glasgow," submitted by Mr. J. M. Cherrie, of Parkhead Forge, and responded to by Mr. Underwood, U. S. Consul; "The Association of Foremen Engineers," proposed by Mr. P. Denny, Jr., and replied to by the Croupier; "Shipbuilding and Marine Engineering on the Clyde," proposed by Mr. J. W. Millar, replied to by Mr. J. P. Wilson; "The Iron and Steel Trades," proposed by Mr. J. Turnbull, Jr., acknowledged by Mr. McLelland, of the Steel Company of Scotland. Other toasts were: "The Railway Interests," "The Visitors," "The Chairman," and "The Croupier." In the course of the evening, which was much enjoyed throughout, several of the company entertained the gathering with songs.

The Eight Hour Movement.

Congress long since enacted that eight hours should constitute a day's work for those engaged in the employ of the United States. The enactment has not been adhered to, and a measure is now before Congress to reimburse those who have worked more than eight hours, for overtime. Should the measure pass, it is estimated that it will take about three millions of dollars to pay the bills. City governments are susceptible to several influences which would favor the success of a movement of this character. The favor of the working classes, the ability to increase the number of employes and thus incidentally reduce the number of needy persons, are some of the considerations which make city governments regard the movement favorably. In a few instances the eight hour system has been adopted by cities, while in others the question is now being agitated.

The arguments used in favor of eight hours constituting a day's work are primarily that it would give employment to many more persons and relieve the glut of the labor market; that it would give more time for recreation, mental and social improvement, and thus, by bettering the condition of the wage-earning class, elevate society as a whole. Although, as has already been noted, those who demand a reduction in the hours of labor express a willingness to accept a corresponding reduction in wages, it is evident that this is merely a temporary expedient to let employers down easy. The advocates of the eight hour movement expect that after the system has been inaugurated they will then be able to secure an advance of wages to old ten-hour rates. Indeed, as much was acknowledged publicly by the principal speaker at a monster eight hour meeting in Chicago held recently. His words were that "if the eight hour movement is pushed to a successful issue, twenty per cent more labor would be needed, and that as the demand for labor increased, wages would become better and better." This we believe to be the "milk in the cocoanut." The advocates of the eight hour movement expect, in reality, to cut down the working day two hours, and receive the same pay, after a little, as at present.

So important a matter as the dropping off of one-fifth of the hours heretofore constituting a day's work cannot fail to be of great importance to employers, and they are, as a matter of course, considering the subject in its various bearings upon their interests. In a few lines of manufactures, in which most of the labor is done on the piecework system, the adoption of the eight hour system would make no great difference. This would not be the case, however, in many, if not in the majority of cases, where the work is largely done by the piece. An increase in the number of persons employed would require more space, more tools, more machinery or apparatus, and would in some instances call for the employment of additional help which does not work by the piece. This would be particularly true in large cities, and will be apparent to intelligent readers without going into a detailed explanation. In lines in which costly machinery is employed, it is often necessary to keep the machinery running long hours in order to obtain a just return for the investment. On the whole, the conclusion is inevitable that a reduction of the hours of labor is equivalent to an increase in running expenses. This increase may not be quite in the exact proportion of the reduction in the hours of labor, where the piecework plan is in operation, but it will approximate to it in many cases.

In enterprises where labor is paid for by the week or month, the increase in the cost of production by a reduction of the hours of labor is entirely obvious. A concern employing one hundred men ten hours would lose twenty days' work every day by the adoption of the eight hour system; an establishment employing five hundred men would lose one hundred days' work every day. This will give an idea of the amount of reduction in production which would arise from the adoption of the eight hour system, with present working forces. A corresponding reduction of wages, if adhered to, would, of course, relieve employing producers in a measure, but could not altogether compensate for the reduction in labor. But, as we have already noted, it is not expected that wages would remain permanently reduced. It is hard enough now for thousands to live, both day and piece hands, and they would not consent to a reduction in the hours of labor if they expected a corresponding permanent reduction in wages. Such a reduction would only bring increased privation in families whose lot is already hard enough.

The conclusion is inevitable that a general adoption of the eight hour system would increase the cost of production and enhance the price of goods to consumers, including, of course, wage-workers themselves, and would have a tendency to stimulate immigration. How far a restriction of production and enhancement of the selling price of goods would reimburse manufacturers for the disadvantages which we have shown would accompany the proposed reduction in the hours of labor, is a matter which experience only can demonstrate. Capital will not seek investment except where a profitable return seems clear to the investor. How far the adoption of the proposed measure would influence capital unfavorably, it is difficult to say. One thing is already a fact in Chicago, and that is that bids and estimates for public and private buildings, now offered, contain a margin of some thousands of dollars for possible labor difficulties, and this will have the effect, in some instances, at least, of influencing some parties to defer building who would otherwise do so.—*American Artisan.*

PHOTOGRAPHIC NOTES.

Method of Producing Uniform Enlargements.—We recently had occasion to enlarge a small negative of a child clothed in a fine white lace dress, upon gelatine bromide paper, and experienced some difficulty in obtaining sufficient detail in the dress without sacrificing the high lights in the face. An exposure for the face was too short for the dress, inasmuch as the density of the negative in the face was out of proportion to that in the dress.

Having already spoiled one enlargement by over-exposure, we took a pair of scissors and cut out of it the face and other portions of the picture which we wished to have protected, and proceeded as follows: First the image was focused on the enlarging screen, the size of the face being exactly the same as that which had previously been cut out. Then an exposure was made for fifteen seconds on the sensitive sheet, the cap of red glass was next put over the lens, and the cut-out sheet of paper representing the face was slightly dampened and placed in position over the image, on the screen, so that it matched the image exactly. The moisture in the paper was sufficient to cause it easily to adhere to the sensitive sheet. After this a second exposure for fifteen seconds more was made, then the cut-out sheet was removed and the sensitive sheet developed in the usual manner. One portion of the picture had twice as much exposure as that which was masked. As a result, the fine delicate tracery in the white dress was fully brought out, while the high lights of the face and other masked portions were well preserved and of agreeable quality. The dampening of the film of the sensitive sheet while on the screen did not injure in the least the resulting picture.

Improved Screen for Lantern Pictures.—In a lecture recently given before the Society of Amateur Photographers of this city, by Mr. Geo. M. Hopkins, on "Polarized Light," a simple, but effective, screen was employed. It consists of heavy bluish white tracing paper, secured by mucilage or flour paste to a common wood hoop, four feet in diameter.

The audience viewed the pictures from the side of the screen opposite to the lantern, or by transmitted light.

The full benefit of the illumination was thus obtained.

For lanterns lighted by kerosene oil it undoubtedly brings out the full effect of the weak illumination, and is admirably adapted for small sized pictures.

A New Form of Tin.

A new metal, called by the inventor, Albert Assman, of Rahway, N. J., "assayme," is produced by a special treatment of tin. It has all the good qualities of the latter, can be pressed into any shape, or cast into statuary, or used for plate ware of any description. A beautiful bronze color can be given to the metal, or any shade from bronze to a silver color; and as it does not in the least corrode, it is specially valuable as a silver solder. It melts at a temperature of 432 degrees, or 18 degrees less than tin.

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Correspondence.

Steam Yacht.

To the Editor of the Scientific American:

Perhaps my experience will be of some assistance to W. N. McA., Notes and Queries (67), of March 13. I had a yacht almost a duplicate of his. My boat was 2 feet longer, 3 inches wider, and the same draught of water. The boiler was 4 inches more in diameter and same height, engine × 57, wheel 2 inches larger. The change from 2 to 3 blades was no improvement, and to 4 a loss. I then lowered the shaft in stern post sufficient to put in a 32 inch 2 blade propeller, and with 100 pounds steam pressure in boiler could make 12 miles per hour, and have exceeded that speed with higher boiler pressure.

While speaking of the speed of steam yachts, I can assure the owners of the Stiletto that they can increase her speed at least two miles per hour by changing her wheel for a two bladed wheel, 60 inches diameter, and lead 1½ to 1. Of course the shaft would require to be lowered enough to put wheel under the water when boat was at rest. A. S. DICKSON.

Meadville, Pa., March 16, 1886.

Cultivating Paste Eels for Microscope Study.

To the Editor of the Scientific American:

Referring to Mr. James' explanation of the paste eel tricks of microscope venders, in the March 13th issue of the SCIENTIFIC AMERICAN, and the difficulties he mentions in the cultivation of the eels, I would say that I have the best success in preserving the eels by keeping the paste in a wide mouth bottle partly full, and loosely stoppered, and set in a cool place. If cool enough to freeze water, all the better for keeping them, but to grow them rapidly and large, warmth is needed. Whenever I discover that they are not doing well, I add a bit of bread to the paste or make a fresh batch. Rye paste seems to answer best, and a few of the eels transplanted into a fresh bowl of paste in warm weather will multiply so rapidly as to cover its surface in a few days with a thick, yellow coat of them. Paste that contains a good supply of them will keep for weeks without moulding, when, without them, it would be covered with mould in a day or two.

W. G. BLISH.

Niles, Mich., March 13, 1886.

The Earth's Past.

BY RICHARD A. PROCTOR.

The earth's surface has long been recognized as presenting a stupendously difficult series of problems—problems indeed which can never be fully solved. So soon as men gave up the old idea that the crust had been fashioned originally much as it is now; so soon as, turning over the leaves of the great earth volume, they began to read what is recorded there, they found, in the first place, that the record runs back over millions of past years, and, in the second place, that it is full of gaps, of blurred pages, of scarce interpretable passages. Yet imperfect though the record is in many plaees, and hard to read in others, it at least tells us clearly the general history of the earth from the time when first there were lands and seas in her surface as now, and when the rival forces of denudation on the one hand and of land making on the other began the contest which has continued for millions of years in the past, and will last for millions of years yet to come.

We no longer, indeed, look back over such a uniform series of changes as the earlier students of geology contemplated. We no longer regard the layers of the earth as comparable with those of an onion, or formed in uniform succession as to time. We see, for example, that even as, in our own age, the denuding forces are forming new strata out of the materials of Quaternary rocks here, out of Tertiary rocks there, of Cretaceous, Jurassic, and Triassic rocks elsewhere, and in other vast regions, even out of the primary rocks down to the Lower Silurian and Cambrian, nay even to the Archæan rocks themselves, so it has been all the time. The crust of the earth has never presented features purely Pleistocene, or Pliocene, or Miocene, or Eocene—or presented, indeed, any uniform aspect at all; and as the formations have never been uniformly presented, so also the strata have never been uniformly laid down. We can no more say the earth was at one time Carboniferous and at another Cretaceous, than we can say that the soil of England was in such and such an era waste, at another time pasture land, at another crop land.

Yet we can look back over the past history of the earth and recognize her constant, though not uniform, progression from her Archæan condition to her present state.

The problems thus presented by the earth's history, while stupendously difficult in detail, are yet so far soluble that we can find in the action of air and water on the one hand, and subterranean forces on the other, the explanation of the general progression of the earth to her present condition. It is otherwise with those prior changes by which the earth passed to the stage when she was fit to be the abode of living creatures. We have evidence, indeed, here also, but it is not so close at hand. We have knowledge of the chemical and physical laws involved in the problem, but the conditions under which the processes then taking place proceeded were unlike any under which we can now experiment. So far as I know, the problems suggested by the consideration of the earth's fiery youth have not been as yet very closely dealt with. Let us note some of the evidence, and some of the points which may fairly be regarded as clear.

In the first place, I think we are too apt to regard a planet in its fiery youth as more uniform than the earth is as we recognize it now. We find the idea common that there would be a molten mass, with perhaps a solid nucleus and a solid crust, and outside that a complex atmospheric envelope, high up, in which would be suspended immense layers of cloud, enshrouding the real planet from outside view. These ideas seem as likely to be erroneous as the common idea of the earth as inclosed in a uniform series of strata before wind, rain, and storm cut her surface up into mountains and valleys, hills and dales, ravines and gorges. Probably the structure of the earth, when in its fiery youth, was even very much more complex than the contour of the earth's crust is now. All the conditions favored tremendous disturbances. The upheavals and down, sinkings of the crust, for instance, would be very much more active then than now, though it does not follow that the resulting inequalities of level would be greater. Indeed, they would not be nearly so great, for the simple reason that, whatever the actual materials of the forming crust in those times, the intense heat pervading it would suffice to render it too unstable to be able to stand out to very great heights above the mean level. But consider how rapidly it would be changed by the subaerial forces which in those days must have been at work.

On our present earth we have an atmosphere of oxygen and nitrogen producing a pressure of about 15 pounds to the square inch; water is from time to time added to it in the form of vapor raised by the sun's heat from the sea, and it is this water, forming into clouds, and pouring down on the land, which leads to all the denuding work of river, cataract, rain, snow, ice, and glacier. In addition there is the direct denuding action of the air in wind and storm, the direct denuding action of water as the waves of the sea pulsate on their shore lines.

But such denuding forces can be absolutely as nothing compared with the denuding forces which must have been in operation when the earth was young. It is certain that the oxygen and nitrogen now present in the air are but a residuum of what was once there. But besides these gases, now in due proportion for the support of the earth's life, there were immense quantities of carbonic acid gas, of sulphurous acid, sulphureted hydrogen, chlorine, boracic acid, and other destructive gases, some ready to assume the liquid form, and so to be still more destructive. But there would also be immense quantities—whole oceans one may say—of water in the form of vapor. The pressure of that primeval atmosphere would have been so great that the waters of such oceans as would have existed then would not have turned into steam, save at a temperature so far above the boiling point at the present atmospheric pressure that the surface of the ocean would actually have glowed with inherent luster. The water vapor in the air would have been no such cool and pleasant vapor as now exists in our air, but steam at high pressure and intensely hot. The rains falling then would have been torrents of hot water, impregnated with destructive acids, and falling on intensely heated rocks, ready to respond with intense rapidity to the destructive influences of those falling torrents and of the dense, complicated, and destructive atmosphere through which they fell. We may be well assured that the changes taking place in the aspect of the earth's surface during that remote part of her career were far more rapid than those taking place now.—*Newcastle Weekly Chronicle.*

American Mills and Looms.

The cotton manufacture in 1885 shows the total number of mills in the United States as 826, containing 261,228 looms and 12,280,342 spindles, manufacturing 786,000,000 yards of print cloths per annum. Of these, New England has 481 mills, containing 205,011 looms and 9,481,272 spindles, manufacturing 646,000,000 yards of print cloth.

Fall River has 1,742,884 spindles and 40,908 looms. It has 55 mills, with an incorporated capital of $18,139,000, but a probable investment of $35,000,000.

New England has made a large increase in spindles and looms within the past five years.

Fall River has thus nearly one-seventh of the spindles in the country, and about one-fifth of those in New England.

Bacillus of Consumption.

Dr. Cantani, of Naples, having in mind the fact that the bacillus of consumption is destroyed when other bacteria are grown in the same soil, has proposed to eradicate consumption by introducing into the system other bacilli which are injurious only to the germs of the disease. If an organ of the body be attacked by a bacillus dangerous to human life, he would introduce another, harmless to man but fatal to the destructive bacillus. In the case of a consumptive patient, Dr. Cantani introduced a harmless organism, known as the *Bacterium termo*, and found that the *Bacillus tuberculosis* gradually disappeared from the patient's expectorations. The widespread desolation wrought by consumption is more than sufficient to urge the strongest effort on the part of the medical fraternity to discover a successful treatment. It may be possible that this suggestion will bear fruits of the greatest importance. We hope, at least, that it will receive careful investigation.

The Colliery Manager.

Mr. Laurence Hill, a well known Glasgow engineer, is one of the professional examiners of candidates for colliery managers' certificates in the eastern district of Scotland, over which Mr. Ralph Moore is Her Majesty's chief inspector of mines. A few weeks since Mr. Hill was applied to by a young man, with the request that he would assist him in his studies for the examination for one of these certificates; and as every year many men present themselves at the examinations without being qualified, Mr. Hill and his friend, Mr. Moore, thought that it would do a service to intending candidates if they were provided with some outline of the course of study necessary to enable them to secure certificates. Accordingly, the first named gentleman put in writing a reply to the young man who desired to become a candidate; and as it may be equally useful to intending candidates in all the colliery districts of the kingdom, we give it the benefit, says the *Colliery Guardian*, of publicity.

Addressing his correspondent, Mr. Hill trusts that he will understand that it is not for want of wish to assist him in a praiseworthy object, but because it would be wrong for any examiner to give special instruction. This would, he says, be very unfair to other candidates. He makes his correspondent welcome, however, to the following information, and he remarks that he will be recompensed for his trouble if the recipient of the information will circulate it among his friends.

In the first place, he would remark, he says, that if his correspondent is only now (February) beginning to prepare himself for the approaching examination, he would not advise him to come up this year, but to use all his spare time from now till next year to prepare himself, as he cannot cram himself in a few weeks or months. Much patient study is required for the examination.

1. The candidate must be able to write a good, clear, and legible hand.

2. He must be able to express his ideas in a clear manner.

3. He must be well up in ordinary arithmetic, and if he understands decimals, so much the better.

4. He ought to be able to draw tolerably well.

5. He must understand mechanics, including a knowledge of the steam engine and mining machinery.

The foregoing will be of much use to the intending candidate, whether he continues his mining studies or not.

In addition to these, a mining manager must—

1. Be thoroughly conversant with the Mining Act, that he may know what the government requires for the safety of miners.

2. Know all the different modes of working coal.

3. Be able to survey and make neat plans of coal workings, and of roads above and below ground, and make neat sketches of machinery.

4. Know the best and safest modes of hauling and winding, and the costs of the different systems.

5. Know the best, safest, and most economical modes of sinking.

6. Be well acquainted with pumping machinery and other appliances for draining workings.

7. Have a knowledge of natural philosophy, to enable him to understand the effects of alterations in atmospheric pressure, the ventilation of mines, the strength of materials, the nature of explosives, and the cause and effects of explosions.

8. Have a knowledge of geology, and the nature of upheavals, distortions, and disruptions in strata, dikes, etc.

9. Be well up to the various and requisite precautions for the safety of miners and sinkers; and though not expressly called for by the examination, yet Mr. Hill recommends intending candidates to acquire a habit of taking copious notes, and sketches of any useful thing which may come under their notice, either from books or from personal observation. This and a knowledge of book-keeping will be of great service to them in any capacity.

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THE DAVIS ISLAND DAM ON THE OHIO RIVER.

(*Continued from first page.*)

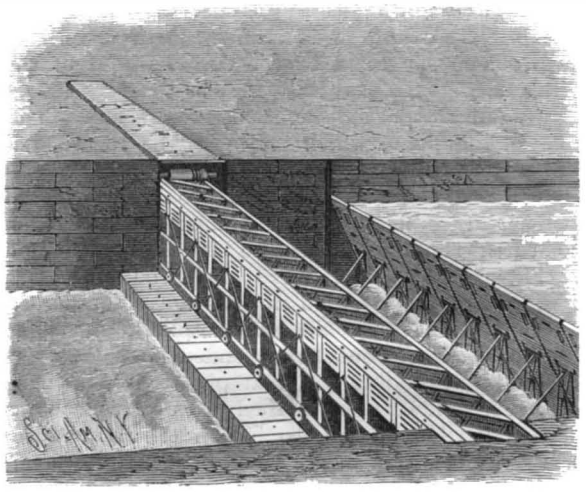
rates the lock from the river. Between the wall and the island the channel is divided into the Pass, 559 feet wide, and three weirs of 224, 224, and 216 feet respectively. The weirs are separated from each other and from the ship channel—the Pass—by masonry piers. The dam consists of a series of 305 movable wickets, which lie flat on the river bed during high water, and are only raised into position when the river has fallen so low as to make navigation difficult or impossible.

The wicket consists of three parts—the wicket proper, the horse, and the prop. The wickets are made of white oak, and are 3 feet 9 inches wide. Their length varies from 12 feet 11 inches in the Pass to 9 feet 9 inches in the weir nearest the island. They are placed 4 feet between centers, thus leaving a space of 3 inches between them, through which the overflow water passes. When the river is too low to permit this waste, pieces of scantling are put down over the openings, the weight of water being sufficient to hold them in place. The wicket is journaled to the horse at a point just a little above its center. The lower part of the wicket is weighted, in order to keep it down. The horse is a frame of wrought iron, 6 feet 8 inches long, which is journaled in a cast iron box in the bottom of the river. These horse boxes are fastened to stout timbers on the river bed, which in turn are secured by iron rods, 9 feet long, to a buried timber which serves as an anchor.

The prop is journaled to the crosshead of the horse, its free end being supported, when the dam is up, by means of the Pasqueau "hurter." This ingenious device is a cast iron box, 9 feet long and open at both ends, which rests upon the bottom of the river. When the wicket is raised into position, the end of the prop slides along the bottom of the box, and up a slight inclined plane occupying one-half the width of the bottom, until it reaches the end of the plane and drops down into a notch, where it is held by the pressure of the water against the wicket.

When the wicket is to be lowered, it is pulled forward slightly until the prop is disengaged from the notch and falls to the bottom of the hurter. As the wicket is lowered, the end of the prop, guided by a beveled edge, slides to one side of the inclined plane, and so along the bottom of the hurter until prop, horse, and wicket are flat on the bed of the river. The Pasqueau hurter, like the entire system of wicket dams, is a French invention. Its characteristic feature, upon which the Pasqueau patent was taken out, is the beveled edge, by which the end of the prop is guided to one side of the inclined plane, and permits the wicket to be lowered.

The wickets across the navigable pass are operated from a "maneuvering boat." In closing the dams, a hook is inserted in the lower end of the wicket. This is then drawn forward until the prop falls into the notch in the hurter, the wicket proper remaining all the time like a feathered oar, with its broad side parallel to the current. When the prop is securely in place, the lower end of the wicket is gradually allowed to sink until it rests against a sill in the bottom of the river. The wicket must be held by the hook until it rests against the sill, otherwise the force of the current would soon prove destructive. When the dam is to be lowered, a hook is inserted into the upper end of the wicket, and, by means of a windlass on board the boat, is drawn in until the prop is disengaged, and allows the whole affair to sink to the bottom. Both in raising and lowering the dam each wicket is operated separately. The system of wickets in the weirs is precisely similar to that in the pass and across the head of the lock, but is operated from a "service" bridge in place of the boat. This bridge is a light iron structure, some feet above the dam, and when not in use collapses at right angles to the current. It is built in sections, as shown in our illustration, and stands 15 feet 1½ inches above the river bed. The supports are 8 feet apart, and are hinged at their lower ends to suitable sills. A section of flooring sufficient to span the intervening space is hinged to each support, and goes down with it. A chain connects the free end of the flooring section with the adjoining support nearest the island. When collapsed, the sections lie flat on the river bed, overlapping each other, after the manner of a fallen row of bricks. When the bridge is to be erected, the section nearest Davis Island is first put in place, and by means of the chain connection, the succeeding ones are one by one brought into position. The supports projecting from the upper side of the piers are in the line of the bridge, and divide it into three larger sections, corresponding to the weirs.



UPPER GATE AND SHORE RECESS.

The lock, in addition to several novel features of construction, possesses an interest as being the largest, both in length and breadth, in the world. A dam of 27 wickets extends across its upper end. This is only brought into requisition when the lock is first used or taken out of use. It is for the purpose of giving slack water in the locks, as it would be impossible otherwise to operate the gates. While the lock is in use, the weir will be unnecessary, as the water will always be slack, either the upper or lower gate being at all times closed.

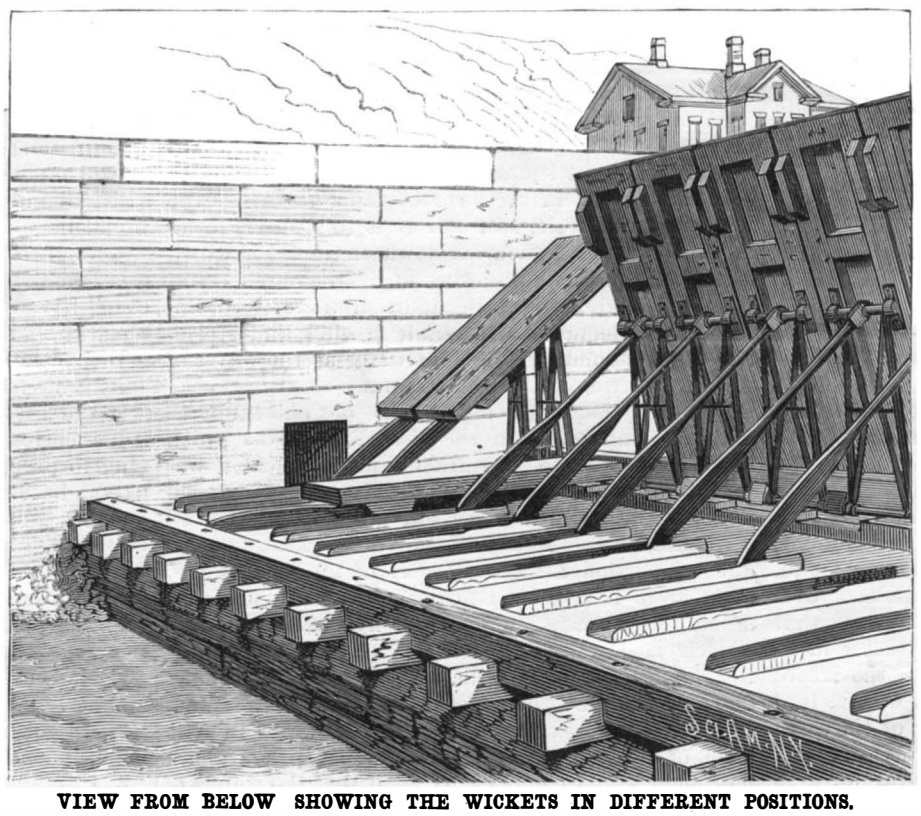
The gates are alike, except in the arrangement of their valves. They are 14 feet high, 13 feet 7⅝ inches wide, and 118 feet long. They are formed of several Howe trusses laid horizontally, and connected by a heavy timber framework. Each gate runs on a track, and when the lock is to be opened, is drawn into a corresponding recess in the river bank. In the lower gate there are 14 butterfly valves, 38 inches in diameter. These are all connected with one shaft, and operate in unison. In the upper gate there are no valves. Each shore recess is provided with seven discharging butterfly valves, 4½ feet in diameter, and in the river wall there are also seven valves, 4½ feet in diameter, making the filling and discharging area of the valves the same. A turbine wheel in the river wall is operated by the water entering the lock through these valves, and its power is utilized to pump water into two tanks on the bank, which have a total capacity of 79,000 gallons. When full, these tanks give a fall of 64 feet, and serve to operate a turbine at each gate. In this manner all power required by the lock is furnished by the river. The turbine at the upper gate is smaller, because less power is required to move the gate. Being so largely of timber, the gate will almost float; and being at the same time so nearly submerged, it has little weight, and requires therefore but little power to operate it. The lower gate, however, is different. It moves almost entirely out of the water, and requires a larger turbine for its operation.

The work of building the Davis Island dam has been subject to a great many interruptions and delays. It has cost the Government about nine hundred thousand dollars. It is presumed that the annual maintenance will be about six thousand.

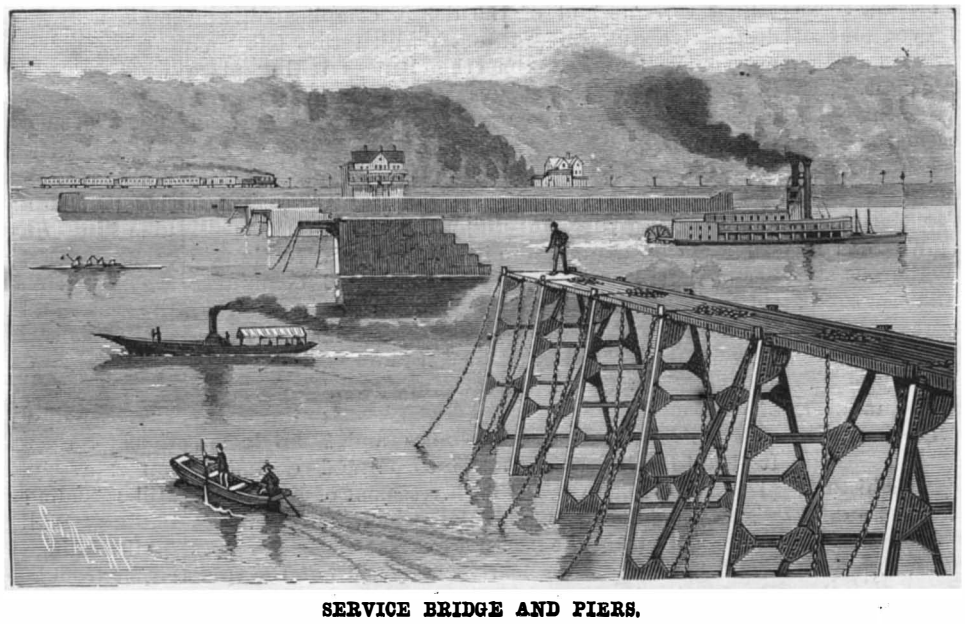
When the dam is up, it gives back water on the Monongahela to Dam No. 1, a distance of 6½ miles, and on the Allegheny to 36th Street, a distance of 7 miles. This makes a depth of 12 feet at the dam and about 6 feet at Pittsburg, giving a pool, therefore, which is navigable in the driest seasons. The dam will only be used for a few months during the summer. Some idea of the enormous tows that pass down the Ohio at this point can be gained from considering a single instance, where 22,000 tons of coal were carried at one time to the markets further down the river. Such a cargo is greater than the famous Great Eastern ever handled, and it is worthy of note that the expense of transportation is lower than in any other system of carriage on record. The coal barges carry about 500 tons each, and the boats about 760 tons. Lashed together, three abreast, and lying low in the water, they look at some distance like immense rafts. The tow boats are large stern-wheel vessels, requiring only about two feet of water. They are always placed back of the tow, and when traveling in a current of much velocity present a curious picture, their large wheels revolving in a reverse direction in order to bring the tow to a controllable speed.

The enormous traffic on the Ohio has reached such a stage that it warrants the systematic improvement of the river in every possible way. The dam at Davis Island is an experimental one, inasmuch as it will probably determine the system of improvement on the entire Ohio. Should it prove successful, similar dams, on the Chanoine system, will be built at various points to the mouth of the river at Cairo. So far, the success of the Davis Island dam, as well as the four on the Kanawha River, has been such that there is little doubt that the system will be widely extended. Forty such wicket dams have been mentioned as being necessary to bring the river into a series of continuously navigable pools between Pittsburg and Cairo.

In addition to its commercial importance, the Pittsburg pool will be the scene of considerable yachting, and already the builders of pleasure craft report a noticeable increase in their business. The slack water and long stretch of several miles make it admirable ground for the oarsman.



VIEW FROM BELOW SHOWING THE WICKETS IN DIFFERENT POSITIONS.



SERVICE BRIDGE AND PIERS.

AMERICAN TIN.—A 9,000-pound mass of tin ore was recently exhibited at a smelting works in New York. It was taken out of a 29-foot vein in the now well-known Etta tin mine, in the Black Hills. The specimen will be sent to London for the benefit of those British tin-mine owners who have so complacently watched our heretofore unsuccessful search for the metal.

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The Explosion of Natural Gas at Murraysville.

One of the most serious and fatal explosions of natural gas that has yet been recorded occurred at Murraysville, Pa., on the 19th ult. In the attempt to make connection with a 16 inch main of the Chartiers Company, a large volume of gas poured into the streets and neighboring houses.

Coming in contact with burning jets of gas, a terrible explosion occurred, fatally injuring several persons and destroying a large amount of property. The fire was then communicated to the big McWilliams well, and a volume of flame at least seventy-five feet high shot up into the air. The flame pouring out of the main was finally extinguished, but it was not until the 22d that the fire at the McWilliams well was put out, and the danger of a general conflagration averted. During this time the entire village was kept in a state of constant anxiety, for there seemed every probability that the neighboring gas wells would take fire, and place the flames beyond hope of control.

For about three days the men employed by the gas companies fought the fire almost incessantly. The heat was so great that they could only work with their heads bound in wet cloths, and then only for three or four minutes at a time. The roar of the escaping gas made conversation impossible anywhere near the burning well. The noise was heard distinctly at a distance of five miles, while the glare of this more than giant's torch kept the night in abeyance over an area of several miles radius.

It was estimated that 3,000,000 cubic feet of gas were being consumed every hour, and that three times that amount escaped into the air unignited. The atmosphere within a radius of 1,500 feet was so saturated with gas that it was almost impossible for a human being to approach the flames and maintain strength and consciousness enough to do any work. As a desperate remedy, it was proposed to cannonade the well, in the hope of either quenching the flame or, by collapsing the pipes, so far reduce the outflow of gas as to bring the flame under control. For this purpose a detachment of Battery B, of Pittsburg, was taken to the scene of the disaster. The suggestion, however, was not carried out, as other means appeared more practicable. Yet it is a curious sight, that of a three inch cannon being dragged twenty miles through mud and rain, to storm this powerful but rebellious servant into submission to his newly found master.

Less revolutionary means were adopted. A trench was dug to within a few feet of the standpipe. Under cover of a fireproof shield, the men gradually accomplished their hard task. A short tunnel was then driven to the pipe itself. By careful chiseling, a ring was cut half way through the tubing. Then began an earnest tug of war. Chains were attached to the standpipe, and 150 men pulled with their might and main. The pipe bent over and broke, and volumes of flame poured out along the ground. The gas afterward became ignited where it issued from the well at the ground. This had one advantage, that it brought the fire all to one spot, the mains having been cut off by the removal of the surface piping. An attempt was then made to drop one end of a long pipe over the jet, so as to extinguish the flame by cutting off the supply of air, but it proved unsuccessful. The force of the outrushing gas threw the pipe to one side. A large funnel like the snuffer of an old-fashioned candlestick was also tried, and failed.

Finally, a large stack was prepared, and one end cautiously pushed toward the mouth of the well. The other end was then raised, and the flame rushed through it with a deafening roar. It was proposed to raise it to some height, and then, by suddenly letting it fall, put out the flame by the draught created. When the stack had reached an angle of about 45°, there was a sudden puff, and the workmen sprang back in alarm. But no further flame appeared. It had been strangled. It is believed the heat was so great that an outward current of air was drawn into the stack in sufficient quantity to form a miniature whirlwind, and thus extinguished the flame.

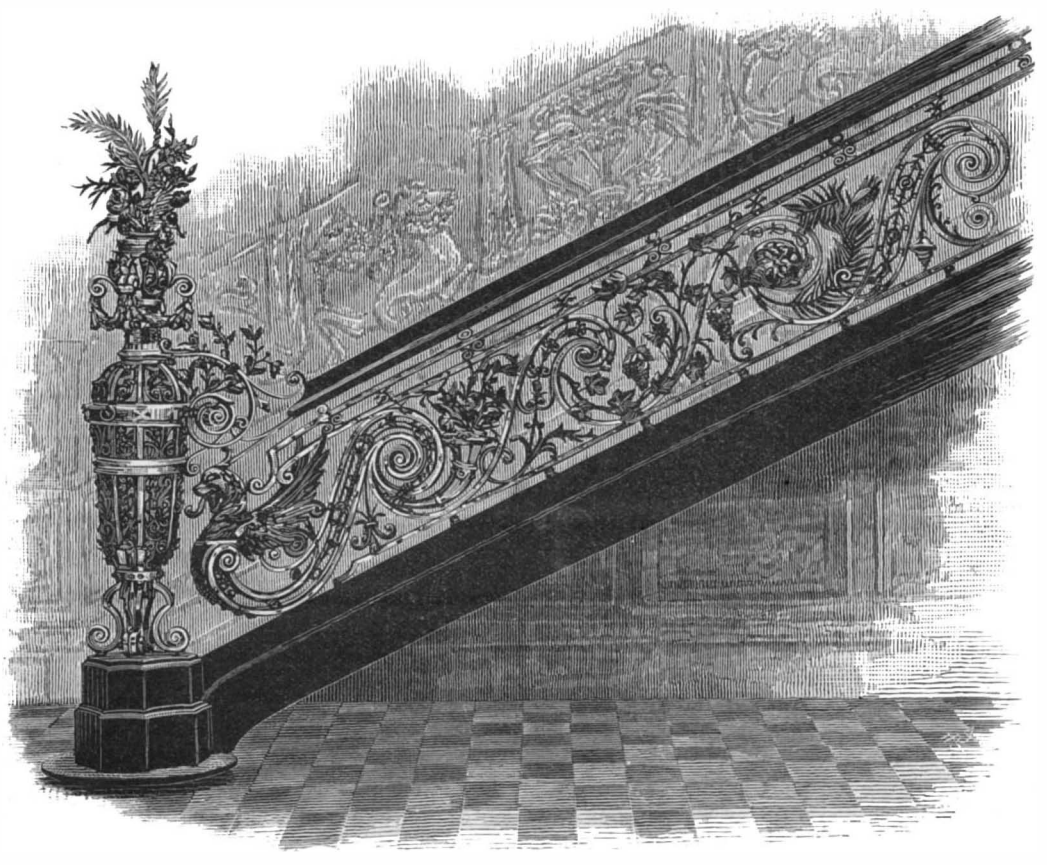
ARTISTIC ARCHITECTURAL DESIGNS.

The studios and residences of artists always possess a peculiar charm for the traveler and sightseer. With a natural love of the beautiful, and with a taste cultivated by study and elevating association, the artist becomes the exponent of refinement and culture. A glimpse into a painter's home is always a treat. The columns, with their beautiful capitals, in the accompanying cut are from

ARTISTIC COLUMNS AND CAPITALS.

the hallway in the residence of the eminent English artist, Sir Frederick Leighton. This house is situated in Holland Park Road, Kensington, London, and is the achievement of Mr. Atchison. The staircase shown in the lower cut is not Sir Frederick's, but is a design of M. Koekx Wouters, of Brussels, Belgium. The banisters are of wrought iron work and of exquisite finish, and executed entirely by hand. This style of work for stairs is comparatively unknown in this country, although it is often found in palaces and residences in Europe. However beautiful, light, and graceful it may appear, the effect produced is hardly commensurate with the great cost attending its construction.

PETRIFIED wood is susceptible of as fine a polish as marble or Mexican onyx, and is taking the place of the latter on the Pacific coast for mantelpieces, tablets, and



WROUGHT IRON STAIRCASE AND BANISTER.

other architectural parts for which marble, slate, and tiles are commonly used. The raw material employed comes mostly from the forests of petrified wood in the territories of Arizona, Wyoming, and the Rocky Mountains, along the line of the Atlantic and Pacific Railway. Geologists will regret the destruction of such interesting primeval remains, and some steps ought to be taken to preserve certain tracts in their original state.

Earth Closets.

To those persons who live in smaller cities, in villages, and in country districts where the advantages of a sewerage system are not accessible, and in large cities where sewers are not extended to outlying districts, there is no such easy and economical method of disposing of excreta as by using earth closets.

The primitive and barbaric privy pits are universally condemned and almost as universally used. Earth closets can take their place in a majority of instances without disturbing the habits of the family, and with great benefit to their health. The old privy can, by a little home carpentering, be fitted into a good earth closet. The pit should be cleaned as thoroughly as possible and refilled with clean earth. The lower portion of the back of the old structure may be fixed as a door to raise up, to permit the removal and placing of the soil containers, which should be either galvanized iron pails or strong wooden boxes. The earth may be kept in a box or barrel, in the structure itself.

The trouble with remodeling the outbuilding for an earth closet is that it makes no change in the publicity of access or the disagreeableness of reaching it in stormy weather. As an earth closet, properly constructed and managed, with a due regard to decency and cleanliness, need not be an offense to sight or smell, it can be so built as to place it in some side room or shed attached to the dwelling and under the same roof. In this case a portable, easily managed closet is necessary.

The value of dry earth as an absorbent, deodorizer and disinfecter is not properly recognized. It is said by some to be more powerful in these capacities than any other agent known. If two parts of dry earth are put with one of excrement, and kept in a dry place, the two assimilate, the excreta becoming undistinguishable from the soil after a time, and it may be used over and over again, though it is generally better to bury each pailful in a different place each time, over a portion of the land adjoining the residence. The earth must not be sand or gravel, but soil of a clayey nature, thoroughly dry and finely pulverized. Powdered charcoal, coal ashes, and street dust are equally effective.

Earth closets offer many advantages, chief of which is that, when they are properly cared for, the excreta of one family is rendered harmless and disposed of on the premises, not being liable to soak into a neighbor's well. There is no offensive odor or contamination of the soil. They may be placed under the same roof as the living rooms, and thus be easily accessible to women, children, and invalids.

There are many failures of earth closets to give satisfaction, but the failure is due to an inability on the part of the owner to understand their capacities. They must not be made the receptacle of house or chamber slops, as the ability of the dry earth to absorb moisture is necessarily limited, and any excess of its capacity creates a nuisance. A great improvement has been perfected in earth closets by Mr. William Heap, in an automatic urine separator, which prevents any undue soakage of the earth, and does away with the only source of annoyance in their legitimate use.

The death rate from zymotic diseases has been shown to have been much reduced by the introduction of proper systems of sewerage, as at Memphis. There is no doubt that the uniform adoption of the dry earth system of soil removal in villages would show a corresponding reduction in the death rate, from typhoid fever especially.—*Sanitary News.*

PROF. LESLIE says: "I take the opportunity to express my opinion in the strongest terms that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is, nevertheless, not only geologically but historically a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject."

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Street Cleaning and Garbage Removal in Boston, Mass.

Before describing the methods of the department under the control of the Superintendent of Health, a word of introduction is, perhaps, necessary to enable our readers to better understand the reason for the prevailing discipline and thoroughness of work performed by this official in Boston.

The secret of success here lies in the fact that the executive head is, first, a very efficient man, and secondly, that this qualification has been appreciated by the appointing powers to such an extent that, though nominally appointed each year, he has actually continued in office for about twenty years. The practical result of this wise though unusual policy in the selection of city officers is a well-trained and efficient corps of assistants and an able, experienced head to guide them. Permanency of employment has made positions in this department, even of the lowest grade, highly desirable; and having many to select from, and being free to choose, the best of the applicants only are selected, the choice of the superintendent being for young married men. This is city civil service of the best type, apparently brought about by an honest desire to benefit the city and the public rather than the political "worker."

The Removal of Ashes, Offal, etc.—In the removal of city refuse, the first requirement of the city ordinances is that no ashes or other material matter or house rubbish shall be mixed with the animal or vegetable waste, usually called "swill." This material must be placed by the householder in suitable separate receptacles; the ashes usually in metallic tubs, so that there may be no danger from fire, and the house waste, or swill, in a tight vessel. These receptacles must be located in an "easily accessible place" on the premises, usually inside the yard; the city scavengers are required to remove them from the yard and return the empty vessels to their proper places.

The "swill" is removed daily from all hotels, markets, restaurants, and other points of rapid accumulation; it is taken from dwelling houses three times a week during the summer months, and twice a week in winter. For this purpose the city is divided into forty-nine districts, to each of which is assigned one swill wagon, a driver, and a helper. With each wagon are two offal buckets, in which the swill is transferred from the house receptacle to the wagon; there is also an offal chisel used in chopping frozen matter out of the house receptacle. This swill wagon has a thoroughly water-tight body, containing about 64 cubic feet, and is closed by tight, hinged wooden covers; there is absolutely no dripping, nor any offensive odor. The collection is made during the whole day up to 5 P.M., and the daily average of each wagon is from two to three loads, depending on the length of haul to the depot.

When the wagon is filled, it is taken to one of three city depots, in Boston, Roxbury, or Charlestown, and the contents are there dumped out upon a tight, raised platform, and the wagon itself thoroughly cleaned inside and out before being sent after another load. This "swill" is readily sold to farmers for feeding hogs and cattle, customers hauling it as far as twenty miles from Boston in tight, covered wagons, which are required on the part of the farmers by the communities they pass through. The prices paid per cord (128 cubic feet) in 1885 were, in Boston, $4; in Roxbury, $5; and in Charlestown, $6.

In the official year of 1884–85, the department employed in this service 108 men and 49 one-horse swill wagons. This force collected 28,520 loads, or, averaging the loads at 60 cubic feet, about 63,400 cubic yards of house offal or "swill." The cost of labor was $87,691.93, and the amount realized from the sale of offal in the year was $36,420.52.

In collecting ashes and house dirt, the city is again divided into seventy-six fixed routes, to each of which is assigned a one-horse cart, a driver, and a helper. This class of refuse is removed from hotels, tenement houses, and stores twice in each week, and from dwelling houses once a week.

The ash carts contain about 44 cubic feet, and must be covered with canvas when being hauled through the streets. The city employes enter the house, yard, or shed of the citizen, and remove the ashes to the cart, but they are not required to go up stairs. This plan practically does away with the nuisance of sidewalks blocked with unsightly or offensive vessels of refuse awaiting the city carts. While the driver is taking the loaded cart to the nearest city dumping ground, the helper remains on the route and transfers the ash barrels to the street ready for the next load. Each cart makes from six to eight trips per day, depending on the length of haul.

At the present time, the main city dump is on the South Boston Flats, where this refuse is utilized in filling low land, chiefly belonging to the State of Massachusetts. This dump is the rendezvous of a motley crowd of general scavengers, who make a precarious l ving by rescuing from the rubbish the rags, bottles, old metal, and any other marketable material found therein. There are other dumping grounds on the Back Bay and in the outlying districts; but as all these dumps will very soon cease to be available, the Board of Health, in 1884, proposed to carry this refuse to sea and there dispose of it. Experiments were made to this end with ordinary dump scows, such as are used in connection with dredges; but owing to the buoyancy and clogging nature of the material, it was found that it would not sink through the bottoms of the scows, and sometimes twenty prisoners from the Deer Island institutions would be engaged fourteen hours in clearing one scow. The Board then tried a Barney dumping boat as used in New York Harbor, and were so well pleased with its performances that in their last report (1885) they recommended the purchase of the boat at a cost of $12,000, and $1,500 annually as royalty. Previous to this recommendation, they had hired the boat for $15 per day.

This Barney dumping boat is 110 feet long, 28 feet wide, and 12 feet deep; its carrying capacity is about 500 tons, and when loaded it draws about 9 feet. It is thoroughly seaworthy in construction, and two men will dump the load, wash out and close the boat, and be ready to return to port in from five to ten minutes. There are two strong hulls, or pontoons, secured together at both ends and in the middle by heavy bridges hinged to the pontoons. The storage room is V-shaped, and the fastenings, at all three bridges, are operated from a center wheel; the pontoons work automatically, and open and close as soon as released, the movement being about one-eighth of a circle. This Barney scow has been in use in Boston since June, 1884, and to April 1, 1885, it had dumped 14,823 loads, making the trip once or twice a week as required. The Board estimated that the saving in horses, teams, and labor exceeded $25,000 in the period named. As an additional source of income, private parties were permitted to dump refuse material into the scow on the payment of ten cents per barrel.

During the year 1884–85, 162 men and seventy-two wagons were employed in the removal of ashes and house dirt. This force collected 182,642 loads of ashes and 62,222 of street dirt; or, with an average of only 40 cubic feet per load, a total of 362,761 cubic yards. The cost of labor for this work was $125,902.21, and the amount received from the sale and removal of ashes was $14,159.76. On this basis, the average cost of collection and removal was about $30\frac{8}{10}$ cents per cubic yard.

There is a "snow drag" used by this department in removing ash barrels from the yard to the street in winter. A club used in loosening up frozen ashes in the barrels of the householders is the source of unceasing tribulation and complaint on the part of the Boston housewife; and besides being a formidable and effective instrument, is perhaps too frequently handled with unnecessary vigor.

Street Sweeping and Cleaning.—This work is done by the city with its own men, horses, and machines. At the present time, about 185 miles of streets are cleaned weekly, the work upon the business streets being usually finished before 7 A. M. During the winter months the teams are employed in moving house dirt and some of the machines in cleaning crossings. In this latter service, experience has shown that a one-horse sweeper will do more and better work than seven or eight men. Only paved streets are swept; on the macadamized and gravel streets in the districts, the gutters are kept clean and paper and other rubbish is gathered up. Sweeping such streets would naturally carry off the top dressing and lessen their durability.

The sweeping machines now used are built by the department under the patent of Aaron Stackpole, Jr., of Oct. 23, 1883. The original machine is intended for one horse only, but the department in some of the latest made have fitted them for two horses by adding a pair of front wheels and a pole. This two-horse machine has decided advantages, and two horses can work in it all day, while in the smaller machine one horse can only work one-half day; the substitution of rattan for the usual "bass" in the broom, though more expensive, is found to be much more efficient, especially in handling slush in winter, and in sweeping gravel from the railway tracks.

The work of street sweeping as practiced in Boston is worthy of a detailed description, both as an evidence of the discipline of the laborers and as a contrast to the slovenly manner in which similar work is performed in some other cities. Taking a street of average width as an example, the first on the ground is a city watering cart, which differs only from that used in ordinary street sprinkling in having finer jets or openings in the sprinkler. After this cart come usually two one-horse sweeping machines, which travel *in echelon*, so that vehicles may pass between them; these machines, commencing in the middle of the street, sweep the dirt toward the two gutters, making several turns over the block if the street is wide. Then come two men with broad hoes, who gather the dirt into rough piles on each side of the street, the distance between piles being regulated by the quantity of matter swept up. Then we have generally four men armed with the ordinary birch brooms, two men to a gutter, who clean up the interval between the piles and go into the angles and corners that the machine cannot reach. And finally come the one-horse carts with two men to each; one man shovels in the dirt, and the other assists him in filling his shovel with the special carter's broom.

In the year 1884–85, there were employed in this service 181 men (87 being sweepers), 34 carts, 10 sweeping machines, and 6 watering carts. The principal streets were cleaned daily, the others twice a week; as previously stated, 185 miles of streets are cleaned each week. The quantity of street dirt removed was about 92,180 cubic yards, and the cost for the year for labor was $97,280.10. This street dirt is disposed of in the same manner as the ashes and house dirt.

So that the cost of street cleaning under the Boston system may be better understood, we have secured the following figures from Mr. M. B. Rowe, who has a general supervision over the work under the Superintendent of Health:

The department "day's labor" is ten hours. The wages paid in 1885 were as follows: Teamsters, $2.10; teamsters' helpers, $2.02; drivers of sweeping machine, $2.10; sweepers, ash cart and offal cart drivers, and their helpers, $2.00 each.

The daily cost, without driver, of a watering cart is figured at $2.00; one-horse sweeping machine, $4.40 (allowance made for two horses, one in the morning, and another in the afternoon); two-horse sweeping machine, $4.75 (here the same two horses work all day); one ash cart and one offal wagon, $2.10 per day each.

To get at some idea of the itemized cost of street cleaning, we have taken, in summer time, a street 66 feet between curbs, and a length of 8,385 feet. The total time occupied in cleaning this area of 553,410 square feet was 2¾ hours. The itemized cost we make as follows from data furnished by the Health Department:

No. employed.	Class of Labor.	Cost per hour.	Total hours.	Total cost.
1	Watering cart	$0.20	2·75	$0.55
1	Driver	.21	2·75	.57¾
3	Sweeping machine	.44	8·25	3.63
3	Drivers	.21	8·25	1.73¼
6	Men with hoes	.20	16·50	3.30
12	Men with brooms	.20	33·00	6.60
8	Carts	.21	2·200	4.62
8	Teamsters	.21	2·200	4.62
8	Teamsters' helpers	.20½	2·200	4.44

Total cost of sweeping 553,410 sq. ft. = $30.07½

At this rate the cost per 1,000 square feet would be $0.054; or on one mile of the same street 66 feet wide it would be $18.81½.

Monster Sea Turtle in Kansas.

The discoverer of a gigantic extinct sea turtle found near Fort Wallace, in Western Kansas, first observed the large bony shields projecting from a bluff near Butte Creek. They were carefully taken out and brought to Philadelphia, where the restoration was made. The fore flippers alone were nearly five feet long, while its expanse from the tip of one extended flipper to another was about seventeen feet. The question may arise, How did the sea turtle become buried in a bluff in the State of Kansas? A natural supposition would be that Kansas is the bed of a former ocean, and so it is. Ages ago, in what is called by geologists the Cretaceous Period, that part of the world was the bed of a great sea, in which the great turtle swam, together with other monsters of curious shape and appearance. Gradually the crust of the earth was raised, the water fell back or became inclosed, and left the inhabitants of the Cretaceous Sea high and dry, to be covered by the earth and preserved for us to study ages afterward.

The shores of this ancient ocean are easily found and followed by geologists. Its extent has been traced on our Western plains by the bleaching and disintegrating remains that have been found, upon and beneath the surface.—*Charles Frederick Holder, in St. Nicholas.*

A Substitute for Sugar from Coal Tar.

Mr. Ivan Levinstein, the President of the Manchester Section of the Society of Chemical Industry, calls attention to a new substance which is extracted from coal tar, and possesses sweetening properties far stronger than the best cane or beet root sugar. This substance, he said, seemed likely to enter into daily consumption. According to Mr. Levinstein, 1 part of it will give a very sweet taste to 10,000 parts of water, for it is 230 times sweeter than best sugar, and taken in the quantities added to food as sweetening material, has no injurious effects whatever on the human system. Patients suffering from diabetes have been treated for the last few months in one of the principal hospitals in Berlin with saccharin without feeling in the least inconvenienced by its use. The use of saccharin would, therefore, Mr. Levinstein said, be not merely a probable substitute for sugar, but it might even be applied to medicinal purposes where sugar was not permissible.

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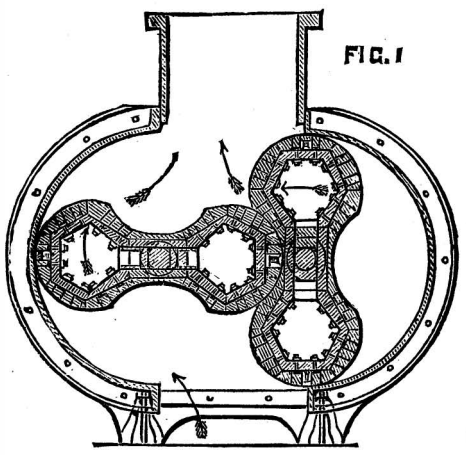
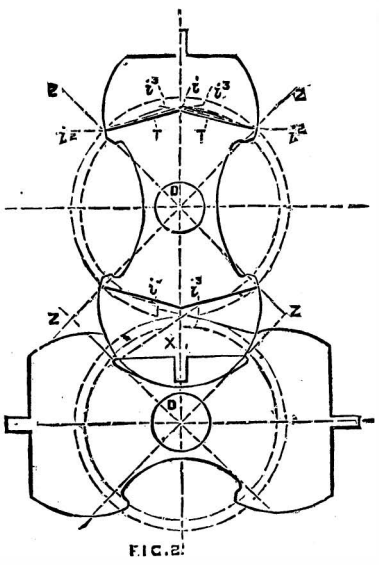
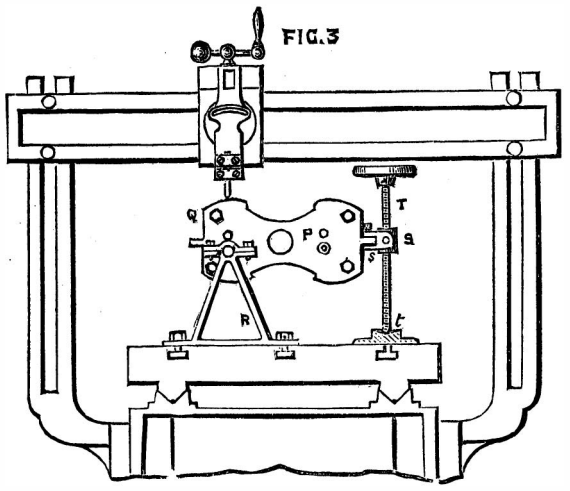
[THE ENGINEER, LONDON.]

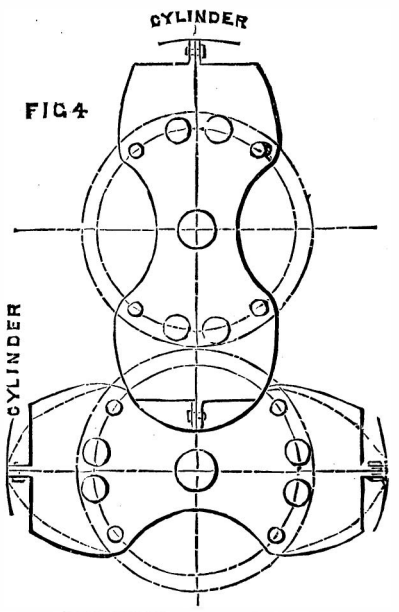
ROOTS' IMPROVEMENTS IN BLOWERS AND PUMPS.

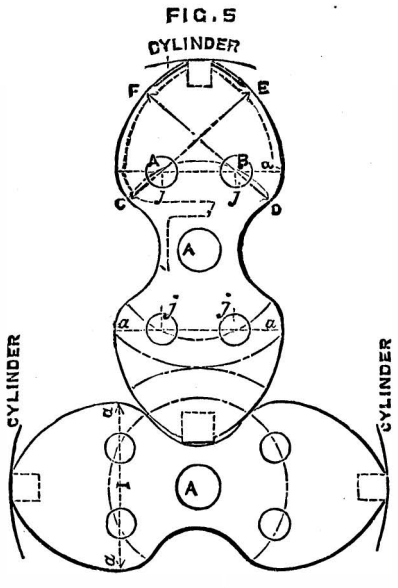
The Roots blower now being a well known machine in this country, though of American origin, some account of its career may be interesting to our readers. It consists of two revolving vanes or abutments geared together so as to keep up constant contact with each other, and with the internal periphery











of a pair of half cylinders. Its success is well known—so much so, that the Roots blower is as much an article of commerce in the machinery world as is a portable engine or a screw cutting lathe. The blower as originally constructed consisted of two vanes or abutments of a form not unlike the figure eight, revolving around each other, their relative positions being determined by wheel gearing. This form, though not scientifically correct, was sufficiently so to insure an approximate contact when made of wood, and hence it formed an efficient machine for a cold blast; but when used, as is now frequently the case, for exhausting hot gases, it became necessary that the revolvers be formed of iron. Then a difficulty arose as to the form of revolvers, as, if made accurately to a semicircle, they would not pass round each other, the curves not being of the correct form, and besides that, it necessitated that the whole of the surfaces of both revolvers should be swept over by a tool, rendering the formation a very expensive process.

This want of sciencific accuracy in the original form led Mr. Roots to improvements, and fresh patents were taken out in 1881 and 1882, and again in 1885. We will now shortly notice the four patents, which will possibly be the simplest way of pointing out the various improvements which have led to the 1885 patent. This last seems to have reduced the difficulties of construction and manufacture so much, and is of so smple a nature, that it is difficult to see how it is that the present form should not have been the one originally adopted. That years of labor and numerous experiments have been expended is another illustration of the fact that even in the design of mechanical tools perfection is only attainable by perseverance and thought. Our illustrations clearly show the various stages which have been passed through, and we think the improvements will at once be appreciated.

Fig. 1 represents the original Roots blower as constructed by Messrs. Thwaites & Carbutt, of Bradford, and now by others. It is not an accurate form—that is to say, if the curves are true semicircles, and closely geared, the revolvers will not pass round each other. Fig. 2 is an illustration of the patent of 1881. The curves in this instance are more accurate, and only the convex surfaces are tooled over. In their formation, however, they require the use of several different centers and radii, which involves a difficulty in setting out, and hence expense in manufacture. Fig. 3 shows the mode of tooling the convex surfaces on an ordinary planing machine. Fig. 4 represents the next improvement and the mode of drilling out the curves. It will be seen not to differ much from Fig. 3. Fig. 5 shows the last constructed curve, which far exceeds those preceding it in simplicity of construction and efficiency. In this case both large and small curves are struck from one common center, thus reducing the construction to the utmost simplicity. By reference to Fig. 5, it will be seen that each half of the vane consists—on each side—of two large and two small curves, and that to produce these four curves only two centers and two radii are employed. The centers are represented by the points A B, and radii A C—A E, B D—B F. Thus the two smaller curves are struck with radii A C and B D, and the larger with radii A E—B F from the centers A and B, which are found by exceedingly simple means, and also the radii. These being fully described in patent No. 10,323, 1885, it will be unnecessary to describe them more fully here. An exterior view of the blower is given in Fig. 6.

As a pump, Messrs. Mather & Platt, of Salford, have taken a license to manufacture, and, we believe, have supplied several to her Majesty's government, the contractors of the Tay Bridge, and others. A very neat design of a combined engine and pump, shown in Fig. 7, is being brought out by Mr. Okes, of Queen Victoria Street, the engine being by Mr. A. C. Mumford, of Colchester, who is acting as Mr. Roots' agent in England. Fig. 7 is a perspective view of the combined rotary pump and engine.

A Specific Gravity Balance for Gases.

Professor Lommel has recently described in *Wiedermann's Annalen* an ærostatic balance for determining the specific gravity of gases, which is claimed to be specially useful for lecture room demonstrations. A closed glass balloon is hung by a wire underneath one arm of a balance, and, thus suspended, is inclosed in a glass vessel, in the cover of which is a hole just large enough for the free passage of the wire. This vessel is provided near the bottom with a tube fitted with a stopcock. The balloon is accurately balanced, while the vessel containing it is filled with air; and then, if another gas of different specific gravity is allowed to enter and displace the air, the balloon will rise or fall according as the gas is heavier or lighter than air. Equilibrium is to be restored by adding weights to one scale or the other, which thus indicate the difference in weight between a volume of gas equal to that of the balloon and an equal volume of air at the same temperature and pressure. The apparatus may be constructed of any desired delicacy, and might easily be made into a handy and inexpensive specific gravity apparatus for coal gas analysis.

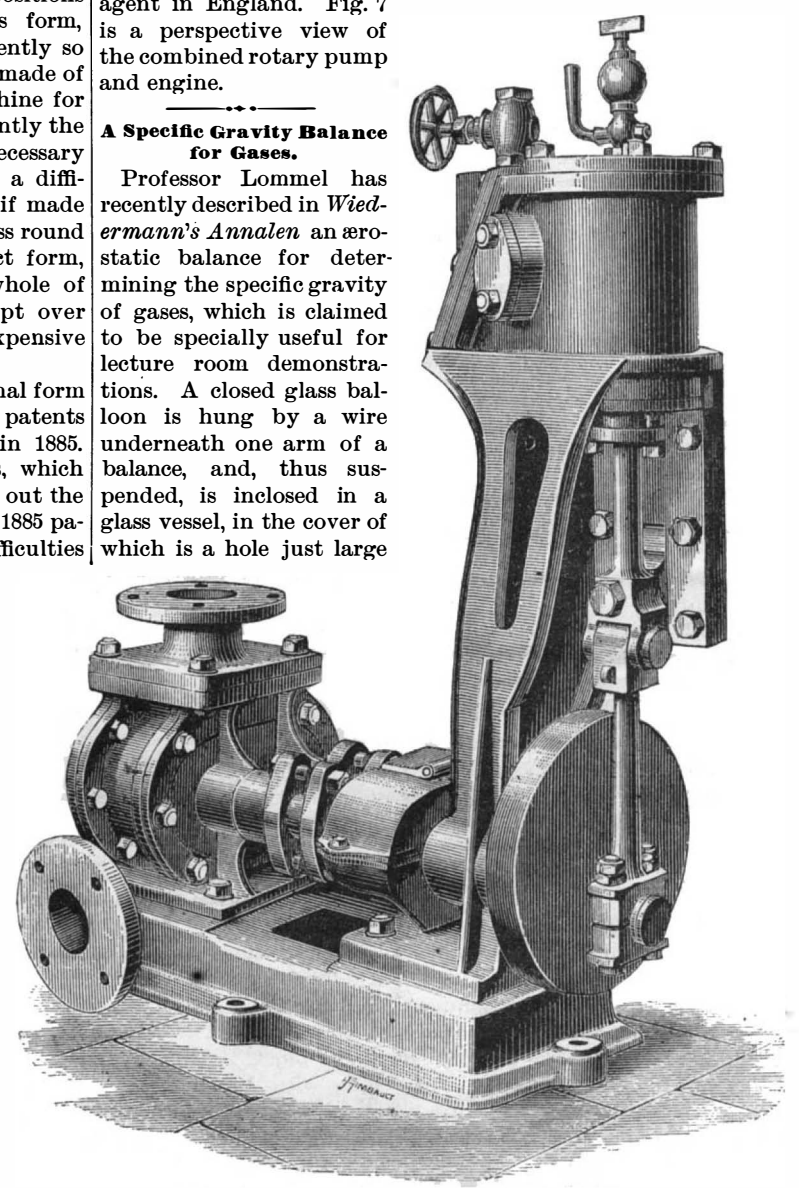


Fig. 7.—ROOTS' COMBINED ROTARY PUMP AND ENGINE.

ROOTS' IMPROVEMENTS IN BLOWERS AND PUMPS

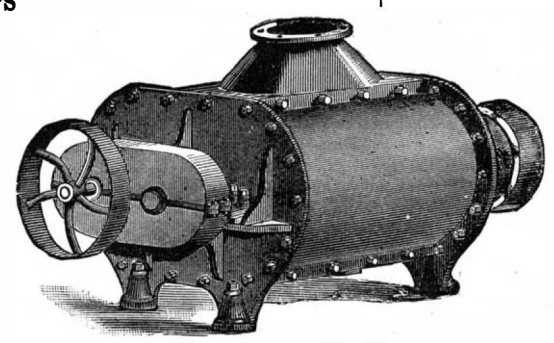


Fig. 6.—ROOTS' BLOWER.

Inoculation as a Preservative against Consumption.

M. Verneuil has lately published a letter to the editor of the *Gazette Hebdomidaire*, M. Lereboullet, in which he proposes to set on foot an experimental inquiry into the possibility of finding some method of "attenuating" the presumed virus of tubercle, so as to make inoculation therewith practically useful against consumption, either as a prophylactic measure, like vaccination against smallpox, or as a means of cure, like Pasteur's inoculations in hydrophobia.

Three thousand francs have already been subscribed, and the respectable names of Cornil, Bouchard, Damaschino, and Potain are mentioned among those who approve of the investigation.

It must, however, be remembered (1) that with the exception of hydrophobia, an exception still on trial, no human disease but smallpox is known which can be prevented by inoculation; (2) that of epizootic diseases, anthrax is only in certain cases guarded against by Pasteur's attenuated virus; (3) that the dependence of consumption on Koch's *Bacillus tuberculosis* is far from established; (4) that its fatality is very far below that of smallpox or hydrophobia, and its treatment far more successful.

Consumption is the most important disease of temperate climates, both by its prevalence, its mortality, and its incidence on young adults; so that the sacrifice of a few rabbits or cats for even a remote chance of controlling its ravages is well justified. But the chance is, we fear, remote.—*Nature.*

THE Chicago *Tribune*, referring to the recent marriage of Mr. Edison and his prolific inventions, concludes that his genius will now be directed to electric candles, electric nursing bottles, electric safety pins, electric machines to get up and walk the baby in the middle of the night, electric devices for cutting teeth, and scaring off whooping cough, croup, and measles, and will contrive other articles for mitigating the troubles, trials, and petty annoyances usual in domestic life.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Calvin Keeler, of Hobart, N. Y. Combined with a drawhead is a lever pivoted thereon, having on its swinging end a fork for holding a pin, with a cam lever pivoted on the forked lever and serving to adjust the link.

A spring frog has been patented by Mr. David H. Lovell, of Renovo, Pa. It has the top of the siding rail and of the spring rail a short distance below the top of the main line rail, and with the frog point beveled, the object being to prevent the breaking of the spring rail by badly worn wheels.

A railroad tie has been patented by Mr. John Gearon, of Alta, Iowa. This invention provides for covering a roadbed with a series of united U-shaped metal ties placed alternately with the shanks projecting upward and downward, the shanks of one tie passing into the recess of the other tie, preventing the growth of weeds, and water from flowing into the roadbed.

A valve gear for steam pumps has been patented by Mr. Abraham Hill, of Marlborough, of Wilts County, England. This invention substitutes for the eccentrics in double cylinder engines a gear whereby the valves will be caused to open and shut quickly, the gear being operated from the piston rod crossheads, the crosshead of each engine working the valve of the other, while the valve gear, being independent of the crank shaft, is unaffected by any play of the latter.

AGRICULTURAL INVENTIONS.

A farm gate has been patented by Mr. William C. Hamner, of Morganfield, Ky. It has a bar extended from its rear end, on which are levers connecting with the gate latch, with various novel features of construction, whereby the gate can be opened and closed at some distance from either side by a pedestrian or one in a vehicle, the gate locking and unlocking automatically.

A combined harrow and replanter has been patented by Mr. David A. Spitler, of Flora, Ind. Its construction is such that when the harrow is being drawn along to kill weeds and loosen the soil, a place being reached where the seed has not germinated, such hill can be quickly and conveniently replanted, the necessary attachments therefor being carried above the ground when not in use.

A fertilizer distributer has been patented by Mr. Alexander Lively, of Sardis, Ga. The box or body consists of sections having meeting edges formed on diverging lines, with batten bars pivoted to and connecting the sections, the adjustment of the sections permitting a greater or less quantity of fertilizer to be distributed by each revolution of an agitator wheel which operates between the lower edges of the sections.

A low binding grain harvester has been patented by Messrs. J. Calder Cunningham and George A. Cunningham, of Washington, Jackson County, Kan. It is made with a long and a short horizontal endless apron, and a driving mechanism connected with the platform frame to receive the cut grain and deliver it at the outer end of the harvester at a level with the platform, with other novel features, whereby grain can be bound without being elevated above the level of the platform.

MISCELLANEOUS INVENTIONS.

A traveling cap has been patented by Mr. Anthony Ward, of Brooklyn, N. Y. It is made of two pieces, the crown and body portion, the latter being provided with visor, cape, and cape lining, all from the same piece of material, to make a winter traveling cap, with very little waste in cutting out.

A pump has been patented by Mr. Hiram Field, of Smithville, Ontario, Canada. It has both lifting and forcing actions, and has large capacity for a given size of barrel, while giving a continuous, even volume of liquid, being especially adapted to lift and force liquids from deep wells and mines.

A wire fence post has been patented by Mr. Eugene Brisbin, of Weston, O. It has a base with central aperture for the post and end apertures for rods which act as braces, with prongs to force through the base into the ground, making a post which is light, strong, and durable.

A baling press has been patented by Mr. George Ertel, of Quincy, Ill. Its construction is such as to regulate automatically the weight of the finished bales, while it smoothes their surface and provides for their being quickly and easily tied, the press being especially adapted for baling hay, straw, cotton, and similar material.

A hose reel has been patented by Messrs. Andrew Schmidt and Charles Revercomb, of Winnipeg, Manitoba, Canada. Combined with a bent axle, carrying wheels, and thills supported on springs secured to the axle, is a reel with mechanism for operating it from the wheels, so that the hose may be automatically wound by running the cart backward over the line.

A tray for developing photographic plates has been patented by Mr. Richard E. Atkinson of New York city. The photographic plate itself is made to constitute the bottom of the tray for retaining the developing fluid, a rubber or other flexible packing being used to make a tight joint for the edges of open frames or sections which close upon the plate or film.

A siding for buildings has been patented by Mr. Albert C. Daugherty, of North Belle Vernon, Pa. This invention consists in making the sidings of uniform thickness throughout, the outer sides of the tongued edges being cut away to form a watershed to each course, and the tongued edges having inclined surfaces through which to nail the siding to the studding.

A salt drier has been patented by Mr. Joseph A. Cook, of Auburn, N. Y. It is a jacketed trough, surrounded by steam, and with an inner heating drum with flanges, which operate, as the drum is revolved, to agitate the salt and to move it along in the trough to the discharge pipe, the apparatus being also applicable for drying sugar and other fine substances.

A check file has been patented by Mr. Thomas A. O'Keefe, of Brooklyn, N. Y. It consists of a series of boards with their front edges beveled, and having numbers, letters, or other marks, the boards being united by upright pieces to form steps, and with pins projecting from their upper surfaces, making an improved file for filing check books or checks.

A banjo has been patented by Mr. Chas. E. Dobson, of New York city. It is made with the forward edge of its rim spun over a wire ring, the spun-over edge and rim having numerous perforations parallel with the axes of the rim and ring and registering with each other, in order to improve the sweetness and clearness of tone of the instrument.

A wagon brake lever has been patented by Mr. Columbus F. Moore, of Waveland, Ind. It consists of a tooth rack operated by pinion that is carried by a jointed rod or shaft, with a novel pawl-operating attachment, with other novel features, for better operating the ordinary form of brake for wagons or other vehicles.

An automatic signal buoy has been patented by Mr. Henry McLaughlin, of Bangor, Me. This invention covers a special construction of a buoy carrying a gong and balls, with guides to direct the balls to strike the gong under the action of the waves or the current, or a similar gong-sounding mechanism may be used on a small raft or boat, etc.

Artificial stone forms the subject of a patent issued to Mr. George Blum, of Orlando, Fla. By this invention an improved artificial stone is made of slaked lime, sulphur, sulphuric acid, common salt, or other saline matter, and sand, mixed in stated proportions, and made in a special machine, which subjects them to a pressure of one ton per brick.

An ax helve wedge has been patented by Mr. Henry F. Sawyer, of Providence, R. I. It is made with two wedge-like prongs tapered flatwise to a point, and separated at their inner edges to give space for the passage between them of a screw, so that when the screw is removed the wedge may be easily pried from the end of the helve.

An automatic attachment for gas stoves has been patented by Mr. John N. Ives, of Brooklyn, N. Y. This invention covers a novel construction of an automatic device for operating the cock in the gas service pipe of gas stoves, to partially cut off the flow of gas to the stoves when no object to be heated is in the stove, thus effecting a saving of gas.

A barbed fence wire has been patented by Mr. James E. Hunt, of Chicago, Ill. A short piece of wire, with its ends pointed to form barbs, is passed through a loop of a fence wire, and wrapped one or more times around the loop, in such way that the pointed ends will project in opposite directions, the short barbed wire being securely held by the way it is twisted.

A ratchet drill has been patented by Mr. Jules Magnette, of Long Island City, N. Y. Combined with the screw socket of the ratchet wheel and the feed screw, having a novel point and head, are intermediate telescoping screws and their stop pins, making a drill which can be readily fed forward, and in which the feed arrangement can be extended or contracted as required.

A waterproofing cloth has been patented by Mr. James H. Sheldon, of Zanesville, Ohio. The method of waterproofing consists in saturating the cloth in a hot solution of gum arabic, table salt, and alum, in soft water, then handling and airing, then saturating in a warm solution of Spanish whiting and prepared chalk, with handling according to a specified manner.

A hame fastener has been patented by Mr. Marsh Noe, of Davenport, Iowa. It has a special form of tumbler and fastening hook, which mutually lock, while there is a stop applied to the hook to avoid accidental unlocking of the hames, and a tongue or guide is applied to the lower ends of the collar to cause a proper registering of the collar and hames when brought together for fastening.

A bouquet holder has been patented by Marietta Flint, of New York city. It is an ornamentally shaped receiver, fitted with an internal holder, the receiver having sponge or other absorbent material in the bottom, and the holder being so fitted as to hold the flowers while providing against water flowing out, there being a hinged pin for attaching the receiver to a garment, a hat, or bonnet.

A land roller has been patented by Mr. Joseph Hafner, of Fowler, Mich. It is for rolling land to crush lumps left by the harrow and bed the seed, but is adapted also for rolling lawns or leveling roads, and its construction is such that the weight of the machine frame and the driver, as well as that of the rollers, will be most concentrated where the land is the highest or the lumps largest.

An axle gauge has been patented by Mr. Hector McQuarry, of Allandale, Ontario, Canada. This invention relates to gauges to determine the bend to be given to an axle so that the lower supporting spokes of the "dished" wheel turning thereon will be always plumb, and the wheel may have the required "gather," the invention being an improvement on an axle gauge formerly patented by the same inventor.

An ore concentrator forms the subject of two patents issued to Mr. William Hooper, of Ticonderoga, N. Y. Combined with a vertical shaft, a driving mechanism, a stirring tub, and a perforated water pipe, is an annular series of radial flaring sluices adapted to have a rotary movement, whereby the head ends of the sluices will be brought successively beneath the feed and the water supply, with other novel features, for separating automatically the floating values, tailings, middlings, and concentrates, and delivering them into separate receivers.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) M. P. B. asks: 1. In which numbers of the SUPPLEMENT are directions for gold plating? A. Nos. 112, 160, 310. 2. Suppose a piece of steel is hardened and drawn to a blue, then repolished, and drawn to a blue a second time. Will the second drawing alter the temper? A. Hardened steel will lose temper by redrawing to a blue each time. If drawn to blue, it may be redrawn to a straw or orange several times without losing hardness. 3. Can a watch that has become magnetized be demagnetized? A. Yes; see SCIENTIFIC AMERICAN SUPPLEMENT, No. 419. 4. Please give directions for etching on hardened steel. A. For etching on steel, cover the surface with asphalt varnish or paraffine mixed with lampblack or asphalt, draw the design with a hard point, and etch with a dilute mixture of nitric acid and water; or, paint the design for bright lines with thin asphalt, and brush and cover all other parts not required to be etched with the varnish, and dip the article in the acid bath.

(2) L. J. S.—Run your leather belts with the grain (or hair) side next the pulley. A little good Labrador oil with a small proportion of tallow makes an excellent dressing, but not much should be used, and what is put on should be allowed to be well taken up by the belt after the latter has been thoroughly sponged off—enough to make it slightly damp. This tends to keep up the life of the leather, and restore it to the condition in which the best belt makers furnish it. The use of beeswax to make a belt pull is a temporary and unworkmanlike expedient for a dirty, overworked, or undersized belt for the power required. Rubber belts need no dressing.

(3) M. W. asks how to recrystallize rock alum. A. Dissolve in water and evaporate slowly until the mass is just about to crystallize; then add a little more water, and place the vessel containing the solution near the heat, and crystallization will probably take place over night.

(4) H. V. P. writes: I have a glass vessel which has been used for an aquarium. It is coated with a film of a milky appearance and lead colored spots. Can you inform me how I can remove them? A. Use hydrochloric acid, diluted with water. Sulphuric acid and potassium bichromate will eat away any organic matter.

(5) F. B. asks: 1. What is the horse power (nominal) of an engine that has a cylinder 16 inches diameter, 18 inches stroke, average pressure 75 pounds steam, 150 revolutions? A. 80 horse power. 2. What causes the water to flow through the injector into the boiler, when the pressure on the boiler check valve is the same as on the injector? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 212, 356, also a little work on the theory of injectors, 50 cents, which we can furnish.

(6) J. J. H., Jr.—The straight link connection for an engine does not meet the requirement of a perfect link movement, and of course is of no advantage.—Cold rolled shafting is made from ordinary round iron, a little larger than the required size, cleaned from scale, and rolled to a finish below the red heat.

(7) G. W. D.—Plating with celluloid or zylonite is a very difficult process, and many of the details of such manufacture are patented. The articles require to be heated to melt the celluloid and make a contact while the thin celluloid sheet is

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pressed to the surface. The surface of the celluloid when cold requires finishing and polishing much in the manner of ivory. It easily takes fire, and is considered a dangerous article to handle near fire.

(8) A. B. S. asks: Can a flue plate on a tubular boiler that has a crack between two flues (distance between flues about ⅜ inch) be repaired, without taking out the flue plate, and if so, how should it be done? A. There is no satisfactory way of repairing a cracked tube sheet. A hole may be drilled and patches bolted on both sides with iron putty for a temporary expedient.

(9) A. E. asks: Which is most economical to use on a 30 horse power engine—a 6 foot or a 7 foot balance wheel; and what is the difference in cost of these wheels, each having an 18 inch face? A. So small a difference will have very little effect. Evenness of motion depends upon weight and diameter of balance wheel. The larger size will give a better effect with the same weight. Apart from the convenience of belting, there is economy in a large balance wheel.

(10) C. A. S. asks: What will remove limestone from steam copper coil? Coil is used in heating water, and deposit is on outside. A. Hydrochloric acid 1 part, water 3 parts. Swab the coil with the mixture, let it stand an hour or two, and wash with a stiff brush and water. Parts that do not come off the first time, treat again.

(11) E. A. C. asks for a marking ink for wooden packages. A. Dissolve asphalt in naphtha or oil of turpentine to a thin fluid. This dries quickly, and the markings are nearly indestructible.

(12) C. A. H. asks a formula for making a cement to cement glass lenses to iron block while grinding. Now use a cement of pitch, resin, and wood ashes, but it often breaks delicate lenses, or during the process of grinding loosens itself from the glass. A. 10 parts resin, 2 parts shellac, 1 part rouge; melt, mix, and add enough turpentine to make it tough, so as not to splinter under pressure from the thumb nail, at the working temperature of the room.

(13) R. & Co. ask (1) how pulverized steatite (soapstone) is applied for finishing walls or ceilings. A. The material is ground with linseed oil, same as any dry pigment is mixed with oil to produce a paint. It is said that by its use the parts coated become fireproof.

(14) L. K. asks what the size is made of that is used to put on flock. A. The size used for flock work is made from glue, but you will find it best to purchase the article from some ink manufacturer. Details of preparation, obtained from long experience, make it possible for these makers to produce a better size than can be made by a private individual.

(15) A. L. S. asks: How many distinct substances are known to science, and how many are used as medicines? A. There are about 67 distinct elements known to science; of these, perhaps 50 are used in medicine.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent usually to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, N. Y.

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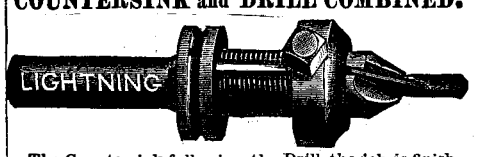

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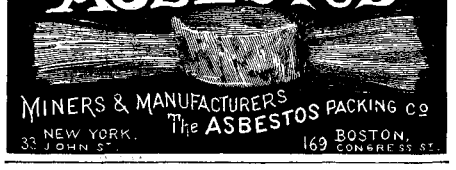

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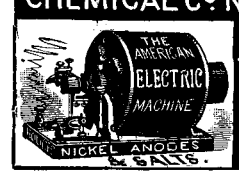

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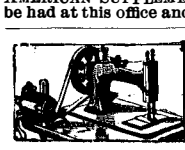

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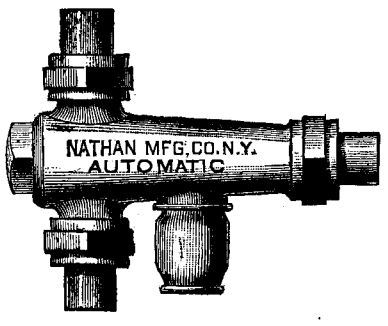

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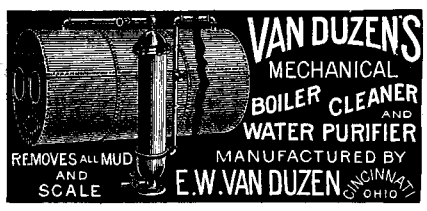

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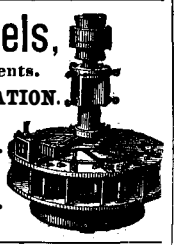

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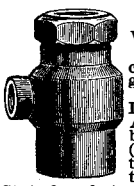
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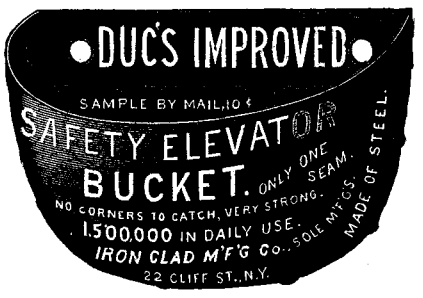
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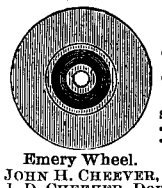
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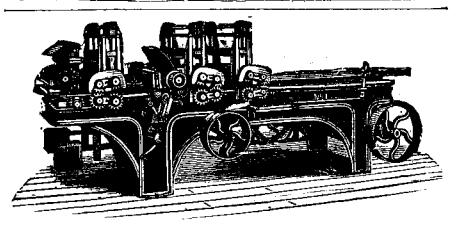
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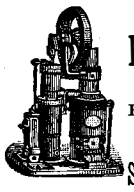
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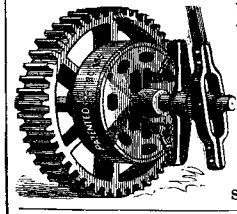
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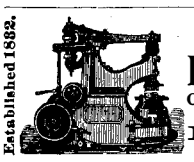

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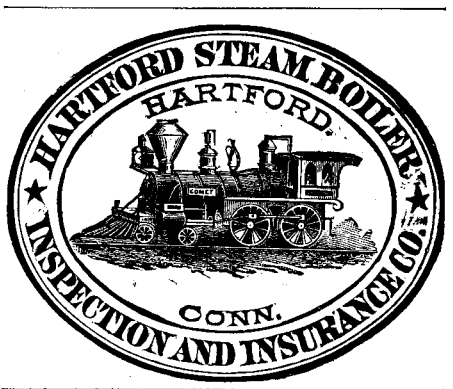

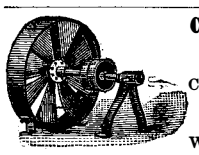

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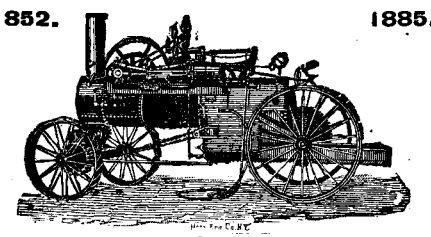

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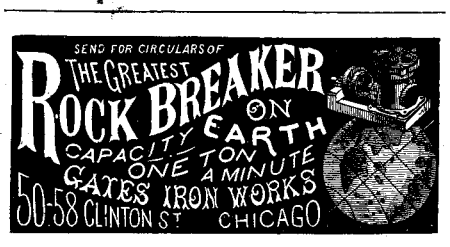

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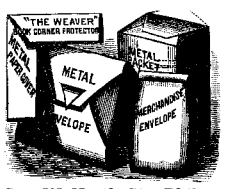

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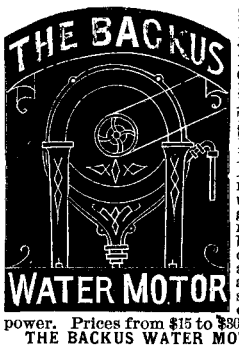

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